Scientific Secrets of Jainism

Research Institute of Scientific Secrets From Indian Oriental Scriptures
Ahmedabad 380 004 (India)

Scientific Secrets of Jainism

(A collection of Articles)

(An exploration of the parallels between Modern Physics and Jain Philosophy)

By

Munishri **Nandighoshvijayji** Gani

Disciple of

Acharyashrivijaya **Suryodayasuriji** Maharaj

Belongs to the Group of

Acharyashrivijaya **Nemisurishwaraji** Maharaj

सर्वद्रव्यपर्यायेषु केवलस्य

Publisher

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Cover picture Lord Mahavira The Unique scientist of the Universe & the *modern science*

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Dedication

I dedicate this book
to
His Holiness Acharyashrivijay Nandanasuriji Maharaj
who initiated me,
My reverend Gurudev His Holiness
Acharyashrivijay Suryodayasuriji Maharaj,
Late Sadhviji Shri Vinitaprajnashriji
who inspired me for initiation
and
worldy mother Vimalaben
who gave me permission for initiation

—Muni Nandighoshvijay Gani

His Holiness

Acharyashrivijay Nandanasuriji Maharaj

His Holiness Reve Gurudev

Acharyashrivijay Suryodayasuriji Maharaj

Reve Sadhviji Shri

Vinitaprajnashriji

Worldy Mother

Shri Vimalabahen

Muni Shri Nandighoshvijayji, delivering a lecture on

"Quantum Mechanics & Janism" at Gujarat Vidyapith,

Ahmedabad on 7th October, 1998

&

Dr P C Vaidya,

addressing the scientists and the scholars, as a chief guest

Publishers Note

Reverend Muni Shri Nandighoshvijayji Gani, a disciple of Acharya Shrivijaya Suryodayasuriji Maharaj belonging to the group Acharya Shrivijaya Nemisuriji Maharaj, has written some comparative and critical articles in Gujarati, Hindi and English languages regarding the various branches of science and Jainism over several years They have been published in various well known magazines (digests) like Navneet-samarpana (Gujarati digest), Tirthankara (a Hindi magazine), Jain Journal (a English quarterly on Jainism), Tulasi-prajna, Arhat-vacana, Parva-prajna etc

Some of them have been collectively published in the two volumes entitled 'Jainism Through Science" by Shri Mahavira Jain Vidyalaya, Bombay They were very well received in India and abroad especially by the large class of the people that has an interest in science as well as in Jain philosophy As both the books and the Gujarati, Hindi and English sections contain different topics, after the publication of these books Prof K V Mardia (Head, Department of Statistics University of Leeds, U K) suggested to publish totally English version for the wider class of the people who is now in foreign

After the publication of the book *"Jainism Through Science"* Muni Shri Nandighoshvijayji has written some new articles They have been also compiled here

Totally Gujarati version of the same book has been published last year and the open-book-exam also successfully arranged by our institute throughout Gujarat state

We are very grateful to Muni Shri Nandighoshvijayji Maharaj for giving the chance to publish his valuable contribution through our institute

It is a pride for our institute that well known and prominent scientists like Dr P C Vaidya Dr Narendra Bhandari (A senior scientist & Professor, Chairman, Solar System & Earth Science, PRL, Ahmedabad) Prof (Dr) K V Mardia (Head, Department of Statistics, University of Leeds U K) and Dr J V Narlikar (Director & Homi Bhabha Professor Inter- University Center for Astronomy & Astrophysics, PUNE) have written introductions or comments to this book We are especially very thankful to them

We are very grateful to reverend Muni Shri Bhuvanacandraji Maharaj for his valuable suggestions and foreword to this book

This is a second publication from our institute and we have great confidence that this publication will wholeheartedly get its importance throughout the scientific world, Jains and non-Jains alike

We are very thankful to our generous donors for their financial contribution Perhaps without their contribution, this publication would not have seen the day of light Simultaneously, we express our thanks to Mr Hemant Parikh and Mr Hasmukhbhai Parikh (Amrut Printers, Ahmedabad) for the finest printing of the book

At last we are thankful to the trustees of Shri Mahavira Jain Vidyalaya, Bombay for giving the permission to reproduce the articles in Gujarati version as well as in English version

President Dr Divyesh V Shah
Research Institute of Scientific Secrets from Indian Oriental Scriptures
Ahmedabad 380 004

A Search for Meeting Points of Science and Religion

Every religion worth the name is basically a way of life, morality and mental purity are its main concerns In other words, religion is a science of life Nevertheless every religion has developed also a philosophy on which its spiritual and moral traditions are based Its code of conduct or the way of life is a logical deduction of its views and theories pertaining to the physical and metaphysical world These very philosophies worked as a springboard for the modern science

Jainism is an ancient religion, well known for its rigid code of conduct It is famous for its philosophy also A closer look at it will convince every student of philosophy that *its approach towards outer as well as inner world is 'scientific'* Jainism does not believe in God Almighty as a creator of the universe, instead like science, it says that the universe is governed by some fundamental laws There are *very few old religions, which can comply with science Jainism is one of those* science-friendly religions It has a vast heritage of knowledge buried in canonical as well as non-canonical books, in which we find a number of facts scattered, which have striking compatibility with modern science Description of atom and sub atomic particles, water as a compound of gas (physics), the value of pi (mathematics), life in vegetables (biology), innumerable suns and moons (astronomy)—these are some references which are considered discoveries of science, but actually are well known to Jainas from thousands of years There is a good deal of such data in scriptures, which resembles the scientific findings of today, with slight difference For instance, Jain scriptures say that Earth rests on three layers *Ghanōdadhi* (solid ocean), *'Ghanavāta'* (solid gas) and *'Tanuvāta'* (fine gas) According to geology, earth's upper crust rests on the 'magma', which resembles *Ghanōdadhi* Is then magma *'Ghanōdadhi'* ? Likewise Jainism believes in six kinds of living beings Among them there are *Pṛthavīkāya* (earth-bodied) and *'Agnikāya'* (fire bodied) organisms Scientists have recently found out new organisms-stromatolites which form the crust of rocks and thermophile, which live in heat Are stromatolites *'Pṛthavīkāya'* of Jain scriptures and thermophiles *'Agnikāya'* ? There are so many 'secrets' in Jain literature which may turn out scientific truths, as the research goes on We cannot rule out all this to be mere coincidence or accidents There are many other things–pyramids, astrology, ESP, OBE, mantra etc etc – which already suggest that our ancestors knew more than we thought they knew

Here some questions may be raised If they knew so many things, which have been discovered by scientists only after life long attempts of research and experiments then why there are gaps in the picture of the universe presented by the scriptures? Why we face differences and difficulties in comparison of scientific data with scriptural data?

Possible solutions for such puzzles may be lying in these points True that we cannot match all the scriptural or traditional data with that given by science, but, as we noted before, we certainly come across many facts that science discovered later, but were actually recorded in Jain scriptures. It may be same in the case of other statements Science might 'discover' them later on Another possibility Surely we face difficulty, discordance and discrepancies in many scriptural references This may be due to the lost portions of scriptures and lost contexts Language is a great hindrance in reaching to right meaning of words In those days people preferred poetic language, afterwards the poetic narrations were taken to be bare facts Thus understanding the scriptural data became difficult In the first place, the seers and prophets were devoted to spiritual developement, they didn't bother to explain each and every thing in the physical world So we can't find a complete picture of the universe and the objects in it Of course they told much about this physical world, but with passing of time, decline of civilizations and due to other calamities much was lost Then people used their imagination to complete the picture, and thus deviations and even alterations took place, therefore we now have a distorted and inconsistent image of the world in our sacred books and other old literature Now time is ripe to unearth the facts from the ancient wisdom deposited in old scriptures and examine them in the light of science

This task is up to not only followers of religions, lovers of ancient wisdom or students of philosophies, but up to scientists also Because science is for mankind and religion also is for mankind They are not apart like poles, but as close as two eyes which work with perfect co-ordination To tell the truth, we can do without science, but not without religion A scientist without religious attitude may create new Hiroshima and Nagasaki disasters We need not only technology, but, over and above it, good character also And character cannot be synthesized in laboratories Only spiritual understanding can make a man, man Religion is like eyes which see, whereas science is like feet which walk

The process of combining both these seemingly opposite trends has now already started Gone are the days when science took religion for mere supersti tions and dogmas, and religious circles considered science an evil, rather a devil, out to distract people from the right path The era of evaluation and assimilation of both the streams has now begun This is why we happen to see books like present one In Jain circles, the systematic study of science began relatively late There are several books on the subject by Jain scholars, very few by Jain monks Muni Nagarajji Muni Abhayasagarji, Muni Amarendravijayji and Muni Mahendrakumar 'Dvitiya'–these are the prominent names of Jain monks who have worked in this direction In this series, the name of Muni Nandighoshvijayji is now added He has studied science with open mind His approach towards science is balanced and healthy, befiting to a follower of the Jainism, which has the principle of 'Syādvāda' (relative truth) at its base He does not discard the findings of science which differ from Jain scriptural beliefs but tries to find out a ground, with regard to scriptural citations, to accommodate the findings of science He does not fall prey to hasty

conclusions and superficial similarities He goes deep and searches for finer and subtler points where both the ideologies meet or even disagree The name of the book is suggestive It implies that there are things in Jain tradition which can be explained by science, therefore these are 'scientific'

While discussing every topic, the author has given a brief account of the development of the relevant theory or the discovery This helps the reader to be familiarized with the subject This indicates also author's concern to give justice to the subject and diffuse the knowledge of science in religious circles I appreciate this very much and wish that learned Jain monks and nuns follow this track Science is going to stay here and it is nothing but a search for truth Technology–indiscriminative use of technology–may be harmful, not science Jain monks and nuns study the literature of six old schools of Indian philosophy and other subjects like astrology, Indian sculpture and architecture Science has to say something regarding all these fields Now it is high time to include science in the curriculum of a Jain monk We cannot turn away from something which helps to see more and that too, with more closely

This book does not announce final conclusions, but really speaking, starts serious examination of two powerful trends–science and religion, opposite like matter and antimatter I hope that we will get much more from the author on this subject And I am sure that this book will go a long way to instill scientific temperament in intelligent groups of Jain tradition and likewise impel the scientifically trained brains to see spiritual data with necessary regard, and inspire them to give an ear to religion which is just another branch of science–the science of life

Bidada, (Kachchha)
27th Feb 2001

- Muni Bhuvanchandra

Philosophy and Science

Generally, philosophy and science belong to different fields of study Philosophy is born out of thinking and science is born out of experience Different types of literature describing and discussing these two seemingly different activities have, therefore, emerged But in spite of this distinction, these are two related activities and the literature discussing their relation has also emerged This collection of articles of *Muni Nandighoshvijayji* belongs to this type of literature

Proficient in Jain philosophical tradition, the Rev Muni is no doubt a learned exponent of the reflective spiritual tradition It is indeed a fact of gratification that he has made tremendous efforts to understand the empirical scientific tradition and it was my privilege to see him absorbed in studying it The author of this collection of articles is thus proficient in former tradition and well acquainted with the progress in the later tradition It will, therefore be very interesting to know his thoughts on the relation between these two traditions

Science is no doubt empirical knowledge but its basic principles are based on reflection But these principles are accepted as scientific only after they have passed through the test of experiments It is, therefore, clear that concentration on the basic principles of modern science is a prerequisite for a discussion of relation between philosophy and science

This collection of articles discusses the following principles of science

(1) Concept of time and its units
(2) Origin and development of the universe
(3) Darwin s theory of evolution
(4) Units of time and their relativity
(5) Atomic theory of construction of material objects, and
(6) Energy, the corpuscular theory and the wave theory of light

The basic scientific introduction of each topic is followed by a detailed discussion of its description according to the Jain philosophical tradition After awakening the reader's interest in the both traditions, the author attempts to compare them

The results of the comparison of these two different traditions will hardly acceptable to all The author, who makes the comparison is proficient in the reflective philosophical tradition If the reader like me, is a lover of the empirical tradition may not fully accept the conclusions of the comparison made by the author But that does not at all diminish the importance of these articles

The reflective tradition is in our cultural heritage The empirical tradition of science has come to us through the contact with the West The Indian reader of today is interested in the comparative study of these two traditions There is no doubt that these articles of *Munishri Nandighoshvijayji* will go a long way in helping the reader to understand and assimilate these traditions

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15-3-1994

P C Vaidya

[With curtsy from the preface of the Gujarati first edition]

An exploration of the parallels between Modern Physics and Jain Philosophy

There is an intimate interdependence between religion, philosophy and scientific thought Sometimes they may operate in different domains, not accessible to the other, but surely there also exists a lot of overlap, where they deal with common subject matter In such a domain, they provide useful feedback to each other, and probably a common basis on which concepts can be developed further Whereas religion should take into account, or be rather based on, the scientific experience and the theories, science is obliged to investigate matters of religious aspiration of mankind, remove superstition and provide logical basis for development of philosophic thought None of them can exist in isolation, nor they can be complete without the other Ideally, therefore, there should not be any conflict between them Their development however proceeds as a different pace since they adopt different approaches The religious thought had its golden age of development during 2500—2000 years ago during the times of Mahavira, Buddha and Christ, whereas the science developed lately during the 19th and 20th century This has resulted in a big gap between the two The present book written by *Muni Nandighoshvijayji* is an attempt to bridge this gap between Jain school of thought and modern science

There are many a hurdles in finding parallelism between science and religion The most difficult one is that of language Science and religion use different terminologies and there are very few persons who can talk about either with equal authority This sometimes may lead to apparent conflicts between the two, which may not exist in reality The other equally serious problem is that of approach Science requires rigorous proofs or observations whereas in religion, it is often adequate to cite the scriptures or quote some authority Unless both of them can be assessed in the same fashion, a credibility does not develop Equally important is the fact that if, after due discussion, one of them is found to be wrong, this should be accepted That is rarely the case In spite of these limitations, a frank discussion of the two may be useful, and lead us to a further insight into the reality of nature

The book covers a wide variety of topics In the beginning it takes up topics such as Special Theory of Relativity, Nature of Light, Doppler Effect, Black-holes etc , many of which form the foundation of modern physics and are deeply entrenched into current scientific thought They have been verified by repeated observations and it is unlikely that they will need a significant refinement as a result of further experimentation or observations— although one must keep an open mind

Quantum mechanics has been one of the greatest achievements of the modern physics It has been able to explain a lot of diverse physical phenomena, but whether it describes the real world in completeness remains to be seen The problem whether light is a wave or a particle has been a fundamental problem of the 19th century physics This dichotomy originated from the fact that the western

science is based on rigid definitions Whether it is this or that, a choice has to be made There is no such conflict with the Jain philosophy since Anēkāntavāda is one of the basic premise on which Jain thought has developed There is no difficulty in saying that light can be both, wave or a particle, or neither, depending on the perspective of the observer and its true nature may never be understood completely In discussion of these scientific topics, some ideas have been put forth, quoting Jain scriptures, some of which may deserve further study It is impressive to see that a variety of topics, as diverse as the origin of life to cosmic time cycles were discussed in the ancient scriptures, in quantitative terms and the theory of Karma, which can in rigour, beauty and complexity is as thorough as the quantum theory was formulated by Jain thought

The topics dealing with mantra, yantra, japa, colour and music point out their importance in the Jain philosophy and spiritual practices and have not formed the subject of scientific investigations It may be easy to feel their effects on human mind but it is difficult to quantify this effect and therefore they have eluded a proper scientific basis If techniques develop which can measure their effects, scientific theories can then be developed Celibacy is one of the corner stones of Jain religion and whereas its importance is accepted by the medical world, there are some new aspects which have been brought to light in this book The bio-electromagnetic energy or extrasensory perception are the topics which are only lately being investigated scientifically

The origin of life on Earth, and in the universe at large is still not fully understood by scientific investigations made so far Jainism seems to have a different approach to the problem and is worth further study In contrast Jain description of geography and human physiology appear rather primitive compared to modern understanding although there may be some elements of human physiology particularly related to spiritual practices which can form a topic of further research

A series of chapters deal with topics where again not much thought has been given in the modern science These mainly concern the food practices Whereas the modern science has confined at determining the calorific values and its classification into vitamins, proteins and carbohydrate content, the Jain school of thought has gone deep into subtler properties of various types of foods and deals with its psychic as well as physical effects This forms the basis of several chapters in this book in which an attempt is made to give some rationales behind the Jain food practices, which is an important part of the Jain religious techniques Long before existence of microscopic life was shown and plants were considered to be living by modern science, these facts were well establishes in Jain philosophy and formed the foundations of complex practices as corollary of nonviolence, which is the basic tenet of Jainism

There can be two complementary approaches for finding parallelism between science and religion Assume science to be correct and find similarities in religious

thought or do the other way around The Muniji follows the latter approach and some of the discussion should be followed with this perspective This has resulted in some difficulties For example, in a chapter related to some conflicting problems between Jainism and modern science, some points have been raised for which there is no scientific rationale An attempt is also made to propose some scientific solutions It is clear that there is much confusion in the units of length *(Gaus, Dhanusya* etc) and time *(samaya)* used in Jain scriptures At least some of the problems can be resolved if the choice of units is correctly made, but it is ultimately to be supported by scientific evidence Geological records, particularly those dealing with fossils form scientific basis of evolution of life and consciousness on the Earth There are no fossils in the geological record which will support human beings being hundreds of feet tall The Carbon-14 method, which can be used only for the period of about 50,000 years, can hardly throw light over events occurring on million year scale

Furthermore the carbon dating is on a firm footing and the dates cannot be in error because of contamination which is known to affect some of the ages determined by this method The discrepancy between some of the problems of this nature can be sorted out by a simple discussion among experts and taking the complementary approach

I have gone through the book with great anticipation, to be able to find some ideas, inherent in Jain thought, which may not be well known to modern science But to find such gems would need a further investigation and understanding of both, science and philosophy May be this book can serve as a starting point for such a pursuit

30th Sept ,1999
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Dr Narendra Bhandari
(Ph D F A Sc ,F N A Sc)
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Science Highlights Jainism

I am honoured to be asked by *Muni Nandighoshvijayji* to write a foreword to his book *"Scientific Secrets of Jainism"* The book is a collection of essays by Muniji written over several years There has not been enough time for me to study all the articles but what I have read has given me a deep impression that Muniji sets out various themes which indicate that Jain science accords well with modern science Jain science is, of course, qualitative as expounded by Tirthankaras whereas modern science is very much quantitative However in both cases the underlying concepts are based on rational arguments Albert Einstein, in his article entitled *"Science and Religion"* (1940, *Nature*, Vol 146, pp 605-607) expressed the situation as

" Science, without religion, is lame,
Religion, without science, is blind "

Jainism is science with religion He adds

"Science is the attempt at the posterior reconstruction of existence by the process of conceptualisation "

Jain science encompasses every aspect of the cosmos, including the living and nonliving entities Einstein also adds

"A person who is religiously enlightened appears to me to be one who has, to the best of his ability liberated himself from the fetters of his selfish desires

Thus, Einstein is describing the Jain way of life Muniji not only describes the historical background to various aspects of the modern science but also compares and contrasts it with Jain science He admirably shows the limitation of modern science Rightly he also appeals to scientists to take up challenges e g on pp 13 "So our scientists have to do a special research in this field (relativity) and they have to put forth scientific secrets shown by our Indian philosophical tradition, before the world with a modern scientific method "

In my book, *"The Scientific Foundation of Jainism"*, (1990, Motilal Banarasidass publishers Delhi), I attempt to render the basic principles of philosophy and ethics of Jainism in terms of modern scientific terminology Such endeavours are required to bring forth Jain science for modern audience - Jains and non-Jains alike I think the writing on *"Jainism as it is"* is one important endeavour, but to put its relevance in the 20th and 21st century s concept is a somewhat harder task which requires urgent attention Even the fundamental Jain concept of Karmic particles as Karmon, Pudgala as mass-energy etc are not well understood A long time before even photons and electrons were discovered, Jain science preached elementary particles such as Karmic particles Karmic particles or *Karmons* are unique concept of Jain science as only these particles can interact with the soul Jain science seems to be the only science which explains both natural as well as *'super natural'*

phenomena, interaction between living and nonliving entities, conscious and physical science

I am not a physicist and have not been able to assess various arguments in the book However, in my opinion, it is a noble task to 'relate' the concepts of modern science to Jain thoughts and vise-versa This examination in itself is, of course, to be done through the principles of *Anekantwada* and *Syadwada* i e through non absolutistic and holistic principles As I had previously suggested that his articles in Hindi and Gujarati would also be translated into English for a wider spectacle, all articles old and new, written by Muniji have been translated into English and are going to be published in a single book entitled *'Scientific Secrets of Jainism'* I am also glad to know that the total Gujarati version has also been published in Jan, 2000

I congratulate him for this important and timely contribution, and in particular, I wholeheartedly recommend it to the scientific community, Jains and non-Jains alike

26th August, 2000

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Professor Kanti Mardia
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Mr Hemant H Parikh
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Dear Mr Parikh

On the * next sheet I give my comments on the book entitled '*SCIENTIFIC SECRETS OF JAINISM* by *Muni Nandighoshvijay*

As a rule I do not write forewords to books by others and hence I am not in a position to write one for this book My comments however are given on the * attached sheet and if the author wishes he can include them along with the comments by other persons which are present in the manuscript sent to me I am sorry for this delay in sending my comments

With kind regards
Yours sincerely

J V Narlikar

Encl * Comments

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COMMENTS ON THE BOOK ENTITLED
"SCIENTIFIC SECRETS OF JAINISM"

by Muni Nandighoshvijay

This book gives some fundamental ideas in modern science and mathematics, side by side with the ideas in Jain philosophy I am not familiar with Jain philosophy, except that I am aware that this philosophy has a rich tradition of high level thinking about nature and life

The scientific topics covered in the book include such subjects as Special Theory of Relativity, Wave-Particle Durability in Quantum Mechanics, Doppler Effect, Black Holes, etc There is also a mathematical discussion of the fundamental number "π" The way this book is organised, one finds alongside the scientific concepts, some information about notions from Jain philosophy

There is one school of thought in India which argues that whatever western science is discovering today was already known to the eastern thinkers long ago The attitude in this book is not of this kind Instead the author has argued that Jain thinking has been more mature, more comprehensive and more satisfying than what science has to offer

By training I am a scientist and I have been impressed by the pragmatic attitude of science where no claim is made to the ultimate truth and all accepted research and theories are based on factual confirmation It is, therefore, difficult for me to accept the alternatives provided here through the medium of philosophy, although I am willing to grant that somebody who is more advanced in philosophy than I am will be better able to appreciate the philosophical arguments advanced in this book

Nevertheless, I think it is an interesting combination of modern science and ancient Jain philosophy and the reader will find it of interest to think over the matters presented here

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July 8, 1987

P Tewari
Engineer SG

Dear Shri Parikh,

Please refer to your letter dated 30th May 1987 to Chairman Atomic Energy Commission alongwith the article entitled Some Shortcomings of the Theory of Special Relativity According to Jainology" prepared by **Muni Nandighoshvijay**

Chairman AEC has asked me to go through the article and write my comments to you I am enclosing herewith my comments and also some relevant literature which could be of interest to you

With regards

Yours sincerely

(P Tewari)

Comments on article entitled " Some Shortcomings of the Theory Of Special Relativity According to Jainology" prepared by Muni Nandighoshvijay

The paper attempts to point out shortcomings in Einstein's Special Theory of Relativity (STR) by putting forth arguments derived from the interpretation of the Jainistic religious philosophy Support has also been taken from the hypothesis on the existence of 'tachyon' which are currently now postulated to have velocity higher than that of light Einstein's postulate that velocity of light is the highest possible velocity in the universe is not supported and a proposition made that velocities greater than light velocity are possible The conclusion drawn is that alternate theories need to be developed taking help from Indian philosophical ideas

While STR has been challenged by many other scientists, and experimental results proving that velocity of light measured by different observers is not the same as postulated by Einstein have been reported the reasons for such refutation of STR are more profound and subtler than what is put forth in the present paper The contribution of Einstein through STR on the insight that each particle of matter has in its structure energy proportional to its mass is an unparalleled achievement in the scientific history

Many a times an interpretation of religious/spiritual texts especially relating to the very basic stage of creation of the universe, if incorrectly done, can lead to results that complicate the further investigations An instance of this seems to exist at page 3, last paragraph, and page 4, first paragraph The interpretation from the Jain philosophy that the 'ONE, by knowing which all is known', is a *particle* of matter, certainly seems to be a mis-interpretation The *Upanishads* and the works of *Adi Shankaracharya* (annexer-1) declare this ONE ' to be a "substratum" rather than a particle , it is the omnipresent and eternal "chidakash"

At page 21, para 3rd it is stated that "Jain philosophy mentions that the earth is steady and the stars planets, the sun the moon etc are moving in the space Certainly such a view is opposed to the accepted fact, at the present stage of scientific investigations on the movement of planets and stars It is likely that when the earth is stated to be steady in Jain philosophy, the reference must have been with respect to the observer on the earth itself

Again at page 36, para 1, it is stated that "as per Jain scriptures, energy of atom is infinite because the velocity of atom is also relatively infinite" For an atom to have infinite amount of energy is indeed impossible

At page 38, last para, the fundamental element of the universe in the Jain philosophy appears to have been mistaken to be in the form of particles, rather than a substratum of energy as stated earlier

Einstein's Special Theory of Relativity is only a crucial step in the development of fundamental physics, with regard to the nature of space, time and matter Further development of physics may lead to the acceptance of more of reality of space than what has been taken in STR It is very unlikely, if not impossible in my view, that velocities higher than light forms the basic postulate of a comprehensive theory of space, energy and matter in future physics

The scientific and spiritual propositions of *Muni Nandighoshvijay* in this paper are of interest

(P TEWARI)

Engineer-SG

Tunes of Inspiration

Knowledge can be acquired through three ways 1 Through experiences and observations i e through experiments, 2 Through logic means contemplation, 3 Through intuition i e instinct or sixth sense

The knowledge obtained through experiments and observation made by our eyes and other sense organs may be sometimes deceptive That means , it is not a absolute truth but it must be relative truth On the other hand, the knowledge acquired through contemplation / logic is also a subject of intellect, but it has also some limitations Some empirical knowledge and all intuitional knowledge can never be a subject of intelligence It will be always beyond logic and intellect

The recognised principles in the science are established after they have passed through the test of experiments Whereas the knowledge obtained through intuition or sixth sense does not require such examination Though the knowledge acquired through intuition is very important for that person and whole society, and is consented by the majority class of society, it has not been accepted as scientific principle But that does not at all diminish the importance of this knowledge In fact, at the end of the life and in the extremely critical circumstances and where science is unable to do anything else the spiritual or intuitional knowledge becomes the nectar

The great persons, having spiritual knowledge through intuition or sixth sense or yoga and meditation and demolition of their inauspicious karma, of ancient time in the Indian culture, have described their experiences in words about the knowledge they acquired This means that the knowledge obtained through intuition by them, has been shown in the scriptures Of course, they are not completely or absolutely true and also it is a partial truth because the omniscient God i e Tirthankara also never able to describe the complete or absolute truth because their life-span is too small to describe the all infinite objects of the Universe and only one object can be described in the speech at a time

The Jain canonical scriptures have been originally composed by the main disciples of omniscient Tirthankara that have seen all the phases of past, present and future of all the elements of the whole Universe like a clean water remaining in a palm

Many scientific principles lie hidden in the most ancient Jain philosophical treatises In modern times, it is very necessary to represent these principles

with the help of modern mathematics and scientific instruments before the world

Of course, this work is extremely difficult and it could not be done by a single person Yet in this book I venture to represent some scientific principles that had been concluded from oriental Jain canonical scriptures during my study and research

Since I am a Jain Muni, there are many limitations regarding practical work I have not tested these principles practically I arrived at such conclusions on the basis of analysis of natural phenomena and social experiences So it is necessary for the readers to notice that the research papers presented in this book are only theoretical

The articles given in the book namely (1) Limitations of the Theory of Special Relativity According to Jainology, (2) Light Waves or Particles ?, (3) Intensity of Light, (4) New Concepts about Doppler's Effect and (5) New Concepts about Interference of Light, are special research papers for the presentation in the annual meeting of Indian Science Congress Association (Calcutta) at Baroda But unfortunately, according to the rules of ISCA and since the research papers are only theoretical, they could not be presented Articles regarding the extra-sensory perception of Shri Ashok Kumar Dutt and their analysis may probably open the doors to new research works

In certain places repetition of some matter may be found But every article being an independent article and being published or to be published in different magazines at different times, repetition of that matter was unavoidable

Direct blessings of my reverehd Gurudeva His Holiness Acharya Shrivijay Suryodayasuriji Maharaj and astral blessings of my 7th ancestral Gurudeva His Holiness Shasan Samrat Acharya Shrivijaya Nemisuriji Maharaj and inspiration and guidance from His Holiness Acharya Shrivijaya Sheelachandrasuriji Maharaj are important factors in my research articles

A learned scholar and Atmasadhaka (Soul-seeker) Muni Shri Bhuvanachandraji, though being physically far far away from me, he has removed all my frustrations and gave me important suggestions to make this book flawless, free from mistakes and credible in scientific world I have possibly incorporated them here

Moreover, I will never forget Prof H F Shah (Head, Dept of Physics St

Xavier's College, Ahmedabad-9) who inspired me and gave enough co-operation in writing these articles Whenever the necessity of exposition and clarification of concept of modern physics and mathematical derivation arose, he explained them to me

Dr P C Vaidya, a great mathematician and scientist not only of Gujarat but also of India who is even at the age of 80 years, today engaged in the research of maths and physics, accepted without any hesitation to write the preface Really, he has devoted his life to researches of maths and physics Many many students have done research in his guidance Even though he is not able to read the manuscript of the Gujarati edition, with the help of reader he read it and wrote an introduction to this book His thanks cannot be expressed in words Moreover, it is my privilege that all the important articles contained in this book have been read by him in its original form and all the suggestions and corrections made by him are incorporated in the text Since 1986, he is giving me guidance and help in the form of valuable books

Dr Narendra Bhandari (Chairman, Earth Science & Solar System, PRL, Ahmedabad-9) also gave me important suggestions & help for my research articles He has also wrote a wonderful comment of this book

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Dr Jayant Narlikar, a well-known Astro-physicist and a Director & Homi Bhabha Professor of Inter-University Centre for Astronomy and Astrophysics, PUNE (India) also sent a brief but excellent comment on this book I am very thankful to him

I highly appreciate Prof (Dr) K V Mardia, the author of the book *'Scientific Foundation of Jainism'* and Head of the Department of Statistics, University of Leeds, LEEDS, (U K) who gave me enough and generous co-operation through the Yourkshire Jain Foundation, Leeds, in my research work He had written a valuable preface of the first Gujarati edition and has also written a preface of this English edition Without his generous co-operation this publication would not have seen the day of light

Also, I especially remember Prof Vasantbhai M Doshi, Who examined the English translation of the articles and rearranged them I am also

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Also, I am proud that Research Institute of Scientific Secrets from Indian Oriental Scriptures,(RISSIOS, Ahmedabad) publishes this book I conclude in expectation that this publication will also bring enough pride to this

institute God bless them I am also very greatful to Mr Harshadbhai K Dave for final proof reading

It is a matter of divine pleasure that with the divine favour of 20th Tirthankara Shri Munisuvratasvami and Ananta-labdhi-nidhana Ganadhara Shri Gautamasvamiji this wonderful publication has been finished without any difficulty

At last, if anything described against the scriptures and the sermon of the Tirthankara Paramatma, I seek forgiveness for it

26 April 2001
Jain Upashray, Shantinagar
Godhra 389 001
India

Muni Nandighoshvijay Gani

Transliteration Chart

अ आ इ ई उ ऊ ऋ ॠ ऌ ॡ ए ऐ ओ औ अं अः

a ā ı ī u ū r ṝ lr lṝ ē aı ō au aṃ aḥ

क का कि की कु कू के कै को कौ कं कः

ka kā kı kī ku kū kē kaı kō kau kaṃ kah

क ख ग घ ङ च छ ज झ ञ

ka kha ga gha na ca cha ja jha ña

ट ठ ड ढ ण त थ द ध न

ta ṭha da dha na ta tha da dha na

प फ ब भ म य र ल व

pa pha ba bha ma ya ra la va

श ष स ह ज्ञ क्ष त्र श्र

śa ṣa sa ha jña ksa tra śra

CONTENTS

1. Limitations Of The Theory Of Special Relativity According To Jainology

It is now ripe time for the reconsideration of the principles of the theory of special relativity and the theory of general relativity that have been established by Einstein because some years ago, an Indian scientist, (now in U S A) Dr E C G Sudarshan has mathematically proved the existence of the particles, named TACHYON that have greater velocity than light-velocity

Till now it is not possible to describe the definite construction and the nature of the atom We do not have a clear idea of the nature of the atom nor can we explain it This shortcoming of ours is explicitly presented in the great scientist Michael Faraday's words pronounced in 1833 A D

'But I must confess I am jealous of the term 'atom' for though it is very easy to talk of atoms it is very difficult to form a clear idea of their nature, especially when compound bodies are under consideration

Till this date these words are almost completely true of the nature and construction of atoms, because as day by day the scientists undertake new research works in the field of fundamental particles, the concepts of construction and characteristics of fundamental particles, become more and more complex

According to the principles of Einstein's theory any physical substance (object) can maintain maximum velocity equal to the velocity of photon particles or light, but can't get more velocity than that of light And also when the object is in motion it becomes shorter in length and its mass increases i e as the velocity of an object increases, its length decreases and mass increases If the velocity of an object becomes equal to the light-velocity its length becomes zero and mass becomes infinite Another remarkable principle of this theory is that as the velocity of the physical body increases, the time interval (the intervening time) between two phenomena decreases and if it becomes equal to the light-velocity, time

becomes steady for that object i e time interval for that object becomes zero

Einstein accepted the velocity of light as constant and it is denoted by 'c' Einstein's principle touches two aspects of this physical world On the one hand it describes the construction and shape of the vast universe and the forces that act upon it and on the other hand it explains the behaviour of the fundamental particles and their characters

Einstein gave an excellent equation for knowing the energy of a substance, $E = mc^2$, where E denotes the total energy of the substance with a mass 'm' 'm' denotes the mass of a substance, and 'c' is nothing but the velocity of light, which is accepted as constant

Einstein gave an equation for calculating the mass of the mobile objects

If the mobile object has the velocity 'v' then $m_v = \frac{m_o}{\sqrt{1 - v^2 / c^2}}$, where m_v denotes the mass of the object in mobile condition, which has the velocity 'v' m_o denotes the original mass of the object when the object is at rest, 'v' and 'c' denote the velocities of the object and light respectively

So when the object maintains the velocity equal to the velocity of a photon particle

i e $v = c$ Then $m_v = m_c = \frac{m_0}{\sqrt{1 - c^2 / c^2}}$

$m_v = m_c = \frac{m_o}{\sqrt{1-1}} = \frac{m_o}{o}$ (by putting 'c' in place of 'v')

And according to the principle of mathematics, if any number is divided by zero it gives value infinite and it is denoted by ∞ As a result we can say that, if the velocity of an object becomes equal to the velocity of light, its mass, becomes *infinite*

The equation for calculating the length of a mobile object is as follows

$L = l'(\sqrt{1 - v^2 / c^2})$

Here L denotes the length of a mobile object, which has the velocity

'v' L' denotes the original length of the object, i e when it is at rest, v and c are the velocities of object and light respectively

In this equation as the value of 'v' increases v^2/c^2 also increases, hence the value of $\sqrt{1-v^2/c^2}$ decreases So we get always $L<L'$ If 'v' becomes equal to c, the value of $\sqrt{1-v^2/c^2}$ becomes zero So L becomes zero In the same way, considering the light-velocity as constant according to the equation $\Delta T = \Delta t\sqrt{1-v^2/c^2}$ i e time interval for the mobile object decreases as its velocity increases And if the velocity of an object becomes equal to 'c', ΔT becomes zero i e time becomes steady for it

Another principle of Einstein's theory is that the summation of two or more vectors does not exist, according to Galilean principle, if two or more forces act on a same object For e g suppose a train has a velocity equal to $^{3c}/_{4}$ i e 2 25 x 10^5 km/sec Let us think that a man, who is travelling in the train, has the velocity $^{c}/_{2}$ i e 1 5 x 10^5 km/sec Then according to Galilean principle, the velocity of the passenger must be 3 75 x 10^5 km/sec {(2 25 + 1 5) x 10^5 km/sec } but it is not true The summation of these vectors, according to Einstein's equation, becomes $^{10c}/_{11}$ which is as follows

$$\vec{V} = \frac{\vec{V_1} + \vec{V_2}}{1 + \frac{\vec{V_1} \times \vec{V_2}}{C}}, \text{ Here } \vec{V_1} = {}^{3c}/_{4}\ \& \ \vec{V_2} = {}^{c}/_{2} \ \therefore$$

$$\bar{V} = \frac{3c/4 + c/2}{1 + \frac{3/4 \ 1/2 c^2}{c^2}} = \frac{5c/4}{1 + 3/8} = \frac{5c/4}{11/8} = \frac{10}{11}c$$

Thus, the summation of vectors, (in any number) must not be greater than 'c' But this principle is only for high velocity - vectors, which reach the 'c' For the common velocity vectors, the result is approximately the same according to Galilean theory and the theory of relativity

The equation that calculates the mass of mobile objects, doesn't give a satisfactory solution for sunlight particles i e photon particles, because this equation tells us that $m_v = \frac{m_o}{\sqrt{1-v^2/c^2}}$

Now, in the case of photon particles, their velocity is 3 x 10^5 km/sec i e equal to 'c' These photon particles are nothing but a special type of fundamental particles, so they must have some mass If the mass of

photon particles is not equal to zero, but even it is a little more than zero, m_t becomes infinite (∞) That is, the mass of photon particles becomes infinite and hence according to Newtonian equation $F = ma$, any type of the greatest force doesn't positively or negatively accelerate the photon particles i e They must be very powerful like micro bullets, and because of their infinite mass they must be black-holes But as we experience in our daily life, the photon particles of sun-light do not have infinite mass, so scientists *have to believe that the mass of photon particles is zero*, when they are at rest

And also this equation can't apply to the particles that have velocity greater than light-velocity, because here 'v' is always greater than c' And if $(v>c)$ v is greater than c, the value of v^2/c^2 must be greater than 1 So we will get negative value of $1 - v^2/c^2$ and *a square root of a negative* number is imaginary So Einstein had to believe that there is no existence of the particles that have greater velocity than light-velocity

But Jain philosophy doesn't accept this posulate As shown in the Jain philosophical scriptures, the particle or an object that has greater velocity than light-velocity can decrease its velocity up to zero and a particle which is at rest now can maintain the velocity many times more than light-velocity We find a reference to this fact in the sacred Jain philosophical treatise named the BHAGAVATĪ SŪTRA *or the* VYĀKHYĀPRAJÑAPTI, which is as follows This reference is in the form of question and answer between Lord Mahāvīra the 24th Tīrthankara of Jainism and his first *disciple* Srī Indrabhūti Gautama It is as follows

परमाणुपोग्गले ण भंते । लोगस्स पुरत्थिमिल्लाओ चरिमताओ पच्चत्थिमिल्ल चरिमत एगसमएण गच्छति पच्चत्थिमिल्लाओ चरिमताओ पुरत्थिमिल्ल चरिमत एगसमएण गच्छति दाहिणिल्लाओ चरिमताओ उत्तरिल्ल० जाव गच्छति उत्तरिल्लाओ दाहिणिल्ल० जाव गच्छति उवरिल्लाओ चरिमताओ हेटिठल्ल चरिमत एग० जाव गच्छति हेटिठल्लाओ चरिमताओ उवरिल्ल चरिमत एगसमएण गच्छति ? हता गोतमा । परमाणुपोग्गले ण लोगस्स पुरत्थिमिल्लाओ चरिमताओ पच्चत्थिमिल्ल० त चेव जाव उवरिरल्ल चरिमत गच्छति ।

(भगवतीसूत्र शतक १६ उद्देशक-८)

paramānupōggalē nam bhantē । lōgassa puratthimillāō carimantāō paccatthimillam carimantam ēgasamaēnam gacchati paccatthimillāō carimantāō puratthimillam carimantam ēgasamaēnam gacchati dāhinillāō carimantāō uttarillam0 jāva gacchati uttarillāō dāhinillam0 jāva gacchati

[illegible]

Reference of Bhagawati Sutra which has been originally composed minimum 1500 years ago, mentioning the maximum velocity of atom (paramanu) in the universe. This manuscript, belonging to the collection of L D Institute of Indology Ahmedabad-380009, having serial No 14407, has been approximately written in the first half of the 16th century of Vikram Era or latter half of the 15th century of A D

uvarillāō carimantāō hētthillam carimantam ēgaO jāva gacchati, hētthillāō carimantāō uvarillam carimantam ēgasamaēnam gacchati ? hantā gōtamā ! paramāṇupōggalē nam lōgassa puratthimillāō carimantāō paccatthimillamO tam cēva jāva uvarirallam carimantam gacchati

(Question) (Indrabhūti Gautam) O, Bhagavān! Does a pudgala i e atom go in one samaya from the extreme end of east of the universe to the extreme end of the west of the universe? and from the extreme end of the west to the extreme end of the east?, from the extreme end of the south to the extreme end of the north?, from the extreme end of the north to extreme end of the south?, from the upper extreme end to the lower extreme end and from the lower extreme end to the upper extreme end of the universe?

Ans (*Śrī Mahāvīrasvāmi*) O, *Gautam'* Yes, In one *Samaya* a *pudgala* atom goes from the extreme end of the east of the *Lōka* (universe) to the extreme end of the west of the universe and so on

(Bhagavatīsūtra, Śataka-16 Uddēśaka-8)

Einstein has accepted the velocity of light as constant but according to Jainology it is improper to accept it as constant because the acceptance of constancy of light-velocity delimits the velocity of paramānu which is 3×10^5 Km/sec But as we referred above the paramānu can go from one end to another end of the universe within a SAMAYA SAMAYA is the most micro unit of time according to Jain philosophy Its explanation will be given later on

According to Jainology there is in the whole universe an existence of only six fundamental elements They are independent of each other, though their combinations are present in the universe They are as follows

1 Jīva i e the living element (soul) 2 Dharma i e the medium for motion 3 Adharma i e the medium for rest 4 Ākāśa i e space 5 Pudgala i e matter 6 Kāla i e Time

From these six elements only the first element is a living element, while the rest are nonliving elements

According to Jainology, time and space both are the elements with their separate existence They are not co-related The theory of special relativity mentions that space and time are co-related A phenomenon, which occurred at one point of space can appear after some time at

another point of space The point of time, when the phenomenon appears at the second point of space, is the present time for the second point and the past time for the first point Thus time is nothing but the measurement of space i e there isn't a separate existence of time

Jain scriptures show that space is divided in two parts, Lōkākāśa, and Alōkākāśa Lōkākāśa, means space belonging to the universe Lōka means the whole universe inhabited by living beings It consists not only of the animal kingdom and the plant kingdom as accepted by the modern science but it also consists of all types of soil-lives, water-lives, fire-lives, wind-lives, and gas-lives as found in Jain Biology Space beyond the Lōka (universe) is called Alōkākāśa, where there is no possibility for the existence of a living being and also Alōka does not include the rest of the four non-living elements Dharma, Adharma, Matter and Time

Moreover the universe is completely filled with two non-material elements named Dharma and Adharma Outside the universe Dharma and Adharma do not exist Though both elements are completely separate from each other, they combine with each other like milk and water Therefore we find both elements in the same space The element Dharma helps the motion of moving objects while the element Adharma helps the stagnation of objects And we have to remember that these elements are not constituted of material particles So the belief fostered by our scientists that every element must consist of material particles and therefore Dharma and Adharma also consist of material particles is improper Since these are non-material elements, they have no material-properties like colour, odour, taste, touch, mass, weight, electromagnetic field, to produce friction and to give response to friction

The most microscopic particles of matter (paramānus) possess these properties As these elements (Dharma and Adharma) are not outside the universe, the elements – matter and soul – can't go outside the universe

Einstein's acceptance of velocity of light to be constant means that the velocity of the source of light doesn't affect the velocity of light e g Though the velocity of the source of light is 2 x 10^5 km/sec the velocity of its own light remains 3 x 10^5 km/sec, but not $\vec{V_1} + \vec{V_2} = \vec{V}$, as the Galilean theory holds It means the velocity of light will not become (3 + 2) x 10^5 km/sec in the possitive direction or (3 - 2) x 10^5 km/sec in negative

direction in respect of the direction of motion Though this belief of *Einstein's theory is partly true, it is not absolutely true* When the velocity of the source of light is more than 'c', the velocity of light becomes more than 'c' And it can be denoted in sign as follows

$c = 3 \times 10^5$ km/sec i e velocity of light or photon particle

$v + c = c$ (If $v \leq c$)

but $v + c = v$ (If $v > c$)

In this condition as the value of 'v' or velocity of the source of light increases the velocity of light also increases It means the velocity of light is not constant but variable If the velocity of light source is greater than the light-velocity, the velocity of light for its own light becomes greater than 'c' and equal to the velocity of light source Not even a little difference takes place in the velocity of light, if the velocity of light source is less than 'c' because in this condition, the ray of light, created at the second moment always remains behind the ray of light, created at the first moment The ray of light created at third moment always remains behind the ray of light created at second moment And at last the source of light remains behind all the rays of light So it is natural that the velocity of light-source doesn't affect the light-velocity

But when the light-source maintains a velocity equal to "c", the ray of light doesn't go outside the source of light because both go with each other and an invisible, unbreakable, screen or wall of light waves gets formed before it

But if that source of light gives off its light in two opposite directions the velocity of light in the opposite direction, relatively to the direction of motion of light source, becomes zero and light could be seen as motionless

But experimental proof is a unique feature of modern science And it accepts all theories after a practical test It is impossible to give a practical proof for the 'superlighnic' objects because such objects can never be seen with our eyes (Here the word *'superlighnic' is used for the objects* having greater velocity than that of light) For this reason Einstein must have said that no object can have velocity greater than the velocity of light

Of course, Einstein's assumption is relatively true because the object,

maintaining a greater velocity than light-velocity must be formed through (from) such a micro and special kind of fundamental particles which should be smaller than photon particles and they should be frictionless or might produce a negligible friction According to Jainism the atoms of every physical substance, are very large in size, so they can never maintain velocity greater than '*c*' But we can't rule out the existence of other types of atoms

The description of types of Varganās i e groups of material particles, in Jain scriptures, also tells us this fact VARGANĀ is a technical word for these various divisions of matter Though the types of these varganās are infinite in the universe, there are only eight classified types of these varganās, which are useful for living beings Their names are as follows -

1 Audārika varganā 2 Vaikriya varganā 3 Āhāraka varganā 4 Taijas varganā 5 Bhāsā varganā 6 Śvāsōcchvāsa varganā 7 Manō varganā 8 Kārmana varganā

All the fundamental particles like electron proton neutron, positron, neutrino, quark etc that have been discovered by our scientists, belong to the first Audārika varganā

SAMAYA -- The Smallest and Basic Unit of Time

SAMAYA is a technical word of Jain philosophical tradition and is used in scriptures to denote the smallest unit of time There isn't a smaller unit than SAMAYA Āvalikā is also a unit of time and a technical word of Jain traditional scriptures According to Jainology 1 Muhūrtta (i e 48 minute) contains 1,67,77, 216 Āvalikās, it means in 1 second, the number of Āvalikās is approximately 5825 4221 Even though there isn't a definite reference in Jain traditional scriptures to the number of SAMAYAs of 1 Āvalikā, we could find that 1 Āvalikā contains uncountable SAMAYAs Here 'uncountable number' means, it cannot be denoted in mathematical terms or equation

Now-a-days, scientists have taken the second as the smallest unit of time and they can measure a pico [one trillionth] second, which is equal to 10^{12} second But this Jain technical word SAMAYA is the smallest unit and though it is difficult to denote it, in terms of seconds, according to the calculation of Śrī Nandalal Jain, we can possibly say that 1 SAMAYA is

equal to approximately, 10^{380} sec to 10^{-600} sec

During this smallest time-unit, SAMAYA, a maximum velocity of the paramānu is 14 Rājalōka (Rajju) It means a paramānu can go throughout the universe or from the lower end to the upper end or from the upper end to the lower end within a SAMAYA A Rajju is the greatest unit of length

Though, C T Colebrook and S'ri G R Jain have tried to calculate the measurement of Rajju, (Rājalōka), it cannot satisfy the belief of Jain scriptures

Muni Śrī Mahendrakumar "Dvitiya" has done hard work to calculate the measurement of Rajju and according to his calculation the minimum measurement of Rajju is as follows

$$Rajju = 4 \times 10^{\{1\,8 \times 10^{245} + 3\}} miles$$

Even though, this value of Rajju is not real, it is more trustworthy than the value of Rajju calculated by Mr G R Jain and C T Colebrook

In this condition it is not proper to say that a particle cannot get more velocity than the light-velocity and also it is improper to say that the particles, which have greater velocity than light-velocity cannot decrease their velocity comparatively with that of light i e it is improper that their velocity never becomes less than light-velocity

$E = mc^2$

In this world - famous equation, Einstein mentions the energy, contained by a substance Here E denotes energy, "m" denotes mass and 'c' is the light-velocity, which has been believed by the scientists as constant and value of "c" is 3,00,000 km/sec If we want to know the energy of a substance, we have to multiply the mass with the square of light-velocity i e 9 0 x 10^{20} cms/sec But as we have shown above the velocity of light is not constant, because the velocity of the source of light affects the velocity of light, if the velocity of light-source is greater than light-velocity, and the velocity of light-source does not affect the light-velocity, if it is less than light-velocity That is why when the source of light has greater velocity than 3 x 10^5 km/sec , the velocity of light-source is considered as the light-velocity Greater the velocity of light-source than 3 x 10^5 km/sec greater the value of c So we have to put v instead of c in the above equation, and

v --> uncountable number i e v --> infinite number but v # infinite number If v tends to infinity, E (energy) also tends to an infinite number

Even though scientists believe that the mass of photon particles is zero, really no particle has zero mass So m (mass) of photon particles, according to Einstein's equation must become infinite and if their mass becomes infinite, the gravitational force becomes infinite So they must be converted into black-holes But really it does not happen It shows that the equation $m_v = m_o / \sqrt{1 - v^2 / c^2}$ is not true

In the same method ΔT never becomes zero for the photon particles and even when we remark that the ΔT becomes zero for the objects that have velocity equal to the light-velocity, it is not a reality but only an imagination

The third fact is as follows It is not true that the length of the object, which has the velocity equal to light-velocity becomes zero If we believe that the length of the object becomes zero which has the velocity equal to the velocity of photon particles, the object must be destroyed and converted into energy But as we know that the photon particles cannot be destroyed by the velocity The object, which has velocity equal to light-velocity, cannot be seen by any one and in this sense the length of that object becomes zero, but it is illusion

(1) $m_v = \dfrac{m_o}{\sqrt{1 - v^2 / c^2}}$ (2) $\Delta T = \Delta t\sqrt{1 - v^2 / c^2}$ (3) $L = L'(\sqrt{1 - v^2 / c^2})$

And also these three equations cannot apply to the objects, that have greater velocity than that of light, that is why these three equations are not proper

Einstein's equation $\vec{V} = \dfrac{\vec{V_1} + \vec{V}}{1 + \dfrac{V_1 x V}{C}}$, for the addition of the vectors is not satisfactory because according to this equation the sum of the vectors which have greater velocity than light is always less than c and if the velocities of two vectors are c and $2c$ the sum of these two vectors becomes equal to c, which is not true

In short all four equations of Einstein are useless for the object, having greater velocity than that of the photon particles While the most learned scientists believe that the equations of classical physics must give a satisfactory interpretation of all physical phenomena from micro to macro i e atomic and sub-atomic particle world and the great heavenly bodies But as we have shown above, the equations of the theory of special relativity can't give satisfactory interpretation of the modern sub-atomic particles and heavenly bodies having a greater velocity than light-velocity So our scientists have to make a special research in this field and they have to put forth scientific secrets, shown by our Indian philosophical tradition, before the world with a modern scientific method

I know very well that this being extremely difficult task, it cannot be done by a single scientist And it can be done by a team of scientists, who have dedicated their life to science and philosophy

I wish that all the scientists will give me enough co-operation in this extremely difficult task

N B - This article had been, originally, written fifteen years ago and I had made a statement that according to Jain philosophy, the velocity of light is not constant and any material particle or object may have greater velocity than that of light

Till now all physicists have accepted that the velocity of light is constant *and no particle has velocity* greater than *light* velocity according to the postulates of Einstein's Special Theory of Relativity

Recently in research carried out in US, particle physicists like Dr Lijun Wang etc of the NEC Research Institute in Princeton have shown that light particle can be accelerated up to 300 times their normal velocity of 1 86,000 miles per second (3,00,000 km per second)

Of course according to the report given in 'The Times of India' dated June 5 2000, details of the findings remain confidential because they have been submitted to *Nature* for review prior to possible publication

Regarding this the famous scientist Dr J V Narlikar says in his article This is not against any result of relativity Because, the point of intersection has a geometrical existence only it has no physical status No material particle is sitting at that point While relativity tells you that no material

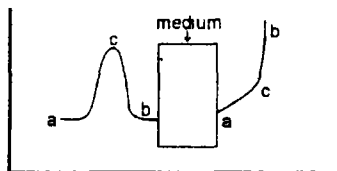
particle can be made to move faster than light More generally it tells us that no physical effect, information can be transmitted across space faster than light So an abstract point of intersection of two straight lines traveling faster than light will not raise any eyebrows in the relativity community

This would only breach one of the basic principles of physics causality, which says that a cause must come before an effect "

Regarding the Tachyon particles the famous scientist Dr Jayant Narlikar writes in his article published in Times of India dated 17 June 2000

"In the early 1960s, George Sudarshan, V K Deshpande and OMP bilaniuk had proposed that nature does allow faster than light particles to exist, only they can never slow down speeds less than the speed of light Called tachyons these particles can travel into the past However, they cannot be used to send information or energy into the past and so they would not create paradoxical situations They are, therefore, not inconsistent with special relativity Do they exist? This is an open question to which the future holds the key "

After reading the article in *'Nature'* dated 20, July, 2000, regarding the experiment carried out by Dr Lijun Wang, crossing the ultimate light speed barrier, Dr Narendra Bhandari (Chairman, Earth Science & Solar System, PRL, Ahmedabad) in his letter dated 2 Nov , 2000 explains as under

"The experiment does not violet the theory of relativity Speeds greater than that of light are known in certain media but only if "information" can be transmitted with velocity greater than C, then only cause and effect can be reversed In the present experiment it does not happen As I understand the waveform changes in the medium as I can better show and express by the following diagram

Because of finite width of the wave part 'b' travels first The peak amplitude is at 'c', but the wave at point 'b' can derive energy from the medium and appears as the peak b' as it goes out of the medium Time taken from c to c' or b to b' is the same as permitted by the velocity of light

but b' (which actually corresponds to b) appears to have travelled faster than velocity of light if it is wrongly considered to correspond to point c, the point of maximum amplitude

In brief, therefore information (which is at point c) has not travelled with velocity faster than light I hope I have explained the experiment clearly though somewhat crudely If I will find some good article on this topic I will send it to you "

There is a news in the Times of India dated 20 Jan 2001 that the scientists Lene Vestergeard Hau of the Harvard University and a team led by Mikhail D Lukin and Ronald L Walsworth of the Harvard Smithsonian Center for Astrophysics in Cambridge have independently reduced the speed of light (photons) to zero for a millisecond

The news are as under

"New *experiments reduce* speed *of* light to zero in a millisecond

Researchers have been able to reduce the speed of light from 186,000 miles per second to zero, trapping the light beams for short periods of time before allowing them to burst forth again at full speed

Now Hau's group and a team led by Mikhail D Lukin and Ronald L Walsworth of the Harvard-Smithsonian Center for Astrophysics in Cambridge have independently gone that achievement better They have brought the light pulse to a complete stop before allowing it to burst forth once again

They could halt the beam for as long as a millisecond before turning the coupling beam back on and allowing the light pulse to re-emerge at full speed "

Of course there was a question for the existence of the tachyon particles but at present after the experiment carried out by Dr Lijun Wang it may be shortly proved

Both the experiments show that the statement regarding the velocity of atoms and sub-atomic particles or the tachyon particles that had been made by me 16 years ago has already been proved today

❁

2. Misunderstanding About The Equation.... $E = mc^2$

$E = mc^2$ is a famous equation that has been established by the great scientist Einstein, and it is related to the special theory of relativity

The special theory of relativity is established on two main postulates, as follows

1 Velocity of any physical particle or object always remains less than the light-velocity

2 The velocity of light, i e photons is constant It means that the velocity of source of light never affects its light-velocity

And according to the second postulate in the equation $E = mc$, E denotes total energy m denotes mass of object, and c is the light-velocity that is accepted as constant

Generally, all, who have not properly studied physics or special theory of relativity know that (1) mass and energy are interchangeable, (2) energy of object or particle is equivalent to its mass multiplied by the speed of light squared [1] In reality 'm' in the equation $E=mc$, does not denote rest-mass but it denotes the mass of particle or object with the velocity 'v' and therefore m is a variable for the same object according to its velocity As velocity increases, m increases and therefore E increases If the velocity of a particle becomes approximately equal to light-velocity, m tends to be infinite It means that the energy of a substance or particle is not constant

In the equation $E = mc$, mc denotes the sum of rest energy m_0c^2, and its Kinetic energy, and it is denoted as $E=mc^2=m_0c^2 + K E$* Here m_0c^2 is constant for the same object or particle, while $K E$ (kinetic energy) is variable according to its velocity So it is a

misunderstanding that mass and energy are interchangeable and energy of the substance with the same mass is constant

Though in practice, any sub-atomic particle never obtains velocity equal to light-velocity**, $E = m_0c^2 + KE$ says us that even the smallest particle of a matter may possess infinite energy and Jain philosophy also denotes that even the atom (paramānu) which is completely indivisible at a given time by any instrument, has also infinite energy

Jain philosophy tells us that light is not an energy-packet but is made up of tiny material particles and its velocity is not constant, it is variable, if the velocity of source of light is greater than light-velocity According to Jain philosophy a particle may obtain velocity greater than light-velocity Thus though the postulates of Einstein and the concepts of philosophical tradition of Jainism, which are *absolutely true, are contradictory to each other they come to same* results

References 1 Holistic Science and Human Values (Quarterly, Feb, 1989 Vol 1 No 1 page 6 column 1)

*Special theory of Relativity Mass-Energy Equivalance

**Beta (β) particles are able to obtain maximum velocity equal to 99c

> THERE THE EYE GOES NOT,
> SPEECH GOES NOT NOR THE MIND
> WE KNOW NOT, WE UNDERSTAND NOT
> HOW ONE WOULD TEACH IT
>
> KENOPNISHAD – 3

3. Light : Waves Or Particles ?

Ever since very ancient times, the sun has been regarded and worshipped as a divine being in India as well as in some western countries such as Italy, Greece etc and it is just and proper for the simple reason that it is the only source of energy in the microcosm and macrocosm and since times immemorial, is giving energy to all living beings in the whole universe and it will no doubt continue to do so throughout eternity

On the strength of the belief that an atom is the cheap, clean and harmless source of energy, all the twentieth century scientists give importance to it as an alternative soruce of energy Experimental experience of a period as long as thirty five years, has proved that atomic energy is neither cheap nor clean nor harmless and therefore, the sun as a source of energy enjoys and will no dout continue to enjoy sovereign position forever In the book ***'The Turning Point'*** the scientist named Fritjof Capra, writes in this connection as under

"Twenty five years ago, world leaders decided to use 'atom for peace' and presented nuclear power as the reliable clean and cheap energy source of the future Today we are becoming painfully aware that nuclear power is neither safe nor clean nor cheap "

The sun gives immeasurable quantity of energy to the whole world only in the form of light Since long, scientists have been doing their best to know the complete structure of light but they have not been able to know fully its structure in its real form

According to some scientists light is in the form of waves, while in the opinion of others it is in the form of particles But scientists have of late unanimously come to the conclusion that since some physical phenomena of light cannot be understood and explained without accepting the particle theory of light and some such phenomena cannot be comprehended or fully explained without accepting the wave theory of light, light is in the form of particles and also in the form of waves

Practically speaking, the particle theory is in reality quite right and it can explain every physical phenomenon pertaining to light All that is needed is introduction of some changes in the fundamental concept of the particle theory The Jainistic theory of light constituents also states that light consists of particles and it is on the basis of the particle theory that transformation of light in various phenomena such as reflection, refraction, interference, diffraction, polarisation etc can be explained

Sir Isaac Newton (1642–1727), the English mathematician and physicist made important discoveries about light He thought about the velocity of light and its ingredients He advanced his reasoning to prove that light consists of microscopic particles

If we accept that light is formed of particles, it follows that the particles of light emanating from illuminated objects, travel in all directions Since light travels in a straight line and since it does not bend its course of travel at the edges of windows, doors etc , Newton preferred the particle theory Though the particle theory, accepted by Newton, could not explain refraction of light or other experimental phenomena on the ground of acquired information, Newton did not meet with any difficulties because he held that the particles of light are different from the generally observed particles

Christian Huygens, the Dutch mathematician, astronomer and physicist, advanced the wave theory of light He argued that if light is formed of microscopic particles, the particles of two crossing light beams must get scattered but this does not happen in practice and therefore, the particle theory of light cannot be accepted

The wave theory of light strongly contrasted the particle theory of Newton The wave theory at that time was in its infancy and could not explain the straight path of light as consistent with unbendability of the light ray at the edges of doors, windows etc But after Newton's death the wave theory acquired development and could explain the straight path of light on the ground of the comtemporarily prevailing condition that the wavelength of light is so small that its acquired bendability at edges of doors, windows etc is so scanty as to be negligible in practical life

A clear shadow of the sharp border of the object is not seen on account of light But in place of a clear shadow one can see illuminated

and unilluminated lines of a definite pattern inside of the shadow Such lines were known at the time of Newton also But the particle theory of light advanced by Newton, could not explain it, while the wave theory could explain it

A J Fresnel (1788–1827) the French physicist developed the wave theory and fully explained all physical phenomena of light that were known at that time

After a lapse of some years Jean Bornard, Lean Foucault (1819–1868), performed a decisive experiment, gave nearly a death blow to the particle theory and the wave theory came into the lime-light The experiment proved that the two theories are definitely different

The velocity of light in vacuum is 3 x 10^5 kms/sec According to the particle theory of Newton there must be greater velocity of light in water than 3 lakh kms/sec Foucault measured the velocity of light and showed that it travels more slowly in water i e , with a velocity less than 3,00,000 kms/sec

Michael Faraday (1791–1867) gave his opinion that there are some magnetic force-line around the magnet and though they are expanded practically in a limited field, theoretically they can be expanded up to infinite distance, that is why magnet can attract the piece of iron or steel

Faraday could not arrive at the mathematical accuracy of magnetic field but James Cleark Maxwell (1831–1879), the British physicist took great interest in the magnetic field and expressed Faraday's thoughts in a form of mathematical equations His contribution in this field is esteemed to be a great work in the 19th century Elongations occurring in the electromagnetic field according to the technical calculations of Maxwell and the emergence of electromagnetic waves in the electromagnetic field were accepted by all scientists as facts of physics, but experimental evidences were not available During that period Maxwell studied the properties and measured the velocity of electromagnetic waves and observed that the velocity of electromagnetic waves is equal in amount to the velocity of light Maxwell's mathematical equations of scientific and technical excellence ramained only on paper for a very long time

In an experiment in a laboratory Heinrich Rudolf Hertz (1857–1894),

the German physicist, succeded in producing an electromagnetic wave, and studied its velocity and properties, which were exactly in accordance with the calculations of Maxwell The radiation found out by Hertz was in the form of wave and it exhibited its reflection and refraction also

Light waves and radio waves are electromagnetic waves They differ only in wavelength and frequency The whole universe is managed exactly in accordance with the few mathematical equations of Newtonian mechanics, Maxwell's electromagnetism and thermodynamics Every physical phenomenon known at that time could be explained by combination of these three sciences And practically speaking, the struggle between the wave theory and particle theory came to an end here But in the fundamental experiment performed by Hertz and in the electromagnetic wave that he generated according to Maxwell's mathematical equation, the particle form of light peeped out to him, but it is no wonder the new radiation having been detected, which Hertz or any other scientist might have overlooked During the experiment performed by Hertz when ultraviolet rays were thrown upon the instrument that generated sparks sparks were speedily and easily generated

Thus the question "Is light formed of waves or particles?" surfaced again in a new form Even after Maxwell and Hertz had expounded electromagnetic waves, there was some doubt in the minds of Hertz and Thomson and the doubt was proper Hertz's doubt was based on the results observed by him in his experiment, while the chief doubt of Thomson was about the 'ultraviolet enigma' which one comes across in the study of radiation of a completely black substance 'Ultra-violet enigma' means radiation of wave with a small wavelength The wave theory of light could not explain either of these phenomena Thus the wave theory of light came to be called in question

In 1880 A D two German scientists named Kirchhoff and Wien carried out their experiments regarding the study of radiation of black substances With the help of thermodynamics, they explained the wavelength of radiation and the changes operative in its intensity They could explain the changes operative in the intensity of waves having small wavelength and also the changes in the greatest wavelength but they could not explain the changes operative in the intensity of waves having greater wavelength

During this period two scientists in Britain, Rayleigh and Jeans by name, carried out their experiments in this field They obtained sufficiently satisfactory results only with reference to radiation having greater wavelengths They used Newtonian mechanics, Maxwell's electromagnetism and statistics of Boltzmann Their study showed that the intensity of radiation of waves of small wavelength was infinite, while experiments showed that the intensity of this radiation was never infinite Thus there arose a crisis in physics

In short there must be an error in at least one of the three sciences used by Rayleigh and Jeans (viz Newtonian mechanics, Maxwell's electromagnetism and Statistics of Boltzmann) or at least one of these three sciences which is not applicable here Moreover these three sciences were the bases of classical physics So they concluded that the experimental results were defective and therefore, they frequently carried on experiments But the results were the same It was thus established that there was no defect in the experiments

Thus when the ultraviolet enigma was explained the wave theory completely failed and about that time, Hertz during his experiment saw the particle form of light presenting itself to the view On the other hand the existence of electromagnetic waves had already been proved in the laboratory Therefore, again the question cropped up What constitutes light – waves or particles ? In the beginning of the twentieth century this question gained prominence In order to be able to answer this question Max Planck (1858–1947) the German physicist, took great exertions In the beginning after some permutations and commutations in his mathematical calculations, Max planck found out a new equation but could not give derivative proof of it With the help of this equation 'the ultraviolet enigma' could be sloved, but in order to give a scientifically derivative proof of this equation Max planck had to undergo immense intellactual labour In the process of solving this equaiton he felt that the principles of classical physics needed to be radically changed After changing these principles he presented his new principle named the quantum theory to the Berlin Academy of Science in the year 1900 A D and the particle theory of light emerged in a new form

According to the quantum theory originated by Max Planck, the emission

of energy, inconstantly takes place in the form of 'quanta' and for that he offered his equation as under

$E_e = nhf$, where E denotes energy getting emission

n denotes 1, 2, 3, 4, 5 and so on i e integer numbers h is the universal constant of Max planck and f denotes frequency of radiation

The value of Planck's constant h is 6 624 x 10^{-34} ergs sec (Joule Sec) Max Planck has named the particles of light as photons Thus in the process of arriving at the solution of the 'Ultraviolet enigma' with the help of the quantum theory, there arose a contigency for accepting the particle form of light and the question regarding the acceptance of the wave theory and the particle theory stood unsolved as before

In England Mr J J Thomson found out electrons and in Germany the scientist named Lenard experimentally proved that electrons are emitted if ultraviolet light of definite frequency is incident upon light sensitive surface of metals i e the emmission of electrons takes place This phenomenon is known as photoelectric effect

In 1905 A D Albert Einstein (1879-1955) the physicist born in Germany, presented the special theory of relativity and on the basis of the quantum theory of Max Planck, he carried out his research works His research work strengthened the quantum theory

Using the phenomenon of photoelectric effect, Einstein presented the views of Max Planck more revolutionarily and thus he showed more widely the use of the quantum theory On the other hand since the existence of electromgnetic waves had already been proved in the laboratory, the thought of the wave theory was still on Max Planck's mind He, therefore stated that when emission of radiation takes place, it takes place in the form of particles and when it propagates from one point to another, it behaves as a wave But Einstein stated that the emission of radiation takes place in the from of quanta (particles) and also it propagates from one point to another in the form of quanta (particles) It means that in the phenomenon called photoelectric effect when light in the form of small particles strikes a metal plate, they throw out the electrons separated from the metal And for the energy of photons connected with the light wave of frequency 'v' he gave the following equation

$E_{ph} = hv$, where E_{ph} is the energy of photon, h is Planck's constant and 'v' is a frequency

WAVES What are waves and how are they created ? If we ponder on this question with a penetrating intellect, it seems more proper to accept the particle form than the wave form of light and sound Generally waves are created through some definite medium but they are not created without medium In science, generally speaking, there are four kinds of waves

1 *Mechanical Waves* Mechanical waves are waves travelling in an elastic medium with participation of particles of the medium The propagation of such waves is due to the elastic property of the medium e g waves on string, sound waves moving in air

2 *Non-Mechanical waves* Non-mechanical waves of light require no medium for their propagation The disturbances corresponding to the electric and magnetic fields travel in space Instead of particles, the electric and magnetic field vectors at all points make oscillations Hence these waves are called electromagnetic waves

3 *Transverse Waves* The waves in which the direction of displacement of particles of the medium, is perpendicular to the direction of propagation of the waves, are called transverse waves In these waves the highest points on shapes bulging out on the upper side are called crests and those on bulging out on the lower side are called troughs The light waves are transverse waves

4 *Longitudinal waves* The waves in which the direction of displacement of particles of the medium is along the direction of propagation of waves are called longitudinal waves e g Sound waves travelling in air or any other media

The particles of the fundamental medium of waves can move upwards and downwards in their own definite place but they cannot go from one point to another point of the same medium In this way they impart kinetic energy to the nearest particles So it is believed that conduction of energy takes place But according to Jain philosophical contention no conduction takes place here but, really speaking minute particles move in light waves, sound waves and electromagnetic waves

De Broglie, the French physicist was awarded the Noble Prize in physics (1929) for his contribution to modern quantum theory In 1927 he demonstrated by experiments that particles exhibit wave like properties and thus established the field of wave mechanics With the help of Einstein's theory of relativity he showed that light is in the form of material corpuscle waves He took it for granted that particles of light (photons) have some mass Though modern scientists believe that a photon has zero mass, De Broglie showed with a mathematical equation that there is a great similarity between light particles and material particles With a number of practical proofs he showed that there are photons in light and it is not possible to say that light is not in the form of wave Both these forms enjoy simultaneous existence

As in the theory of relativity, energy is connected with matter so here also we can connect material particles and its mass with energy and frequency of waves This is as under

- A material particle has mass

- Mass is energy Energy denotes frequency and frequency denotes waves

Thus De Broglie originated a new theory, the material particle-wave theory Even an extremely minute particle can behave as a wave He proved this on the basis of the relativity theory Physics discussed in Jain Philosophical treatises corroborated the same theory And regarding material particles and material waves De-Broglie gave a formula as under

$\lambda = h/mv$, where λ is wave length, m is mass of the particle, 'v' is the velocity of the particle and h is Planck's constant

The velocity of particles used in light i e photons and of particles used in other electromagnetic waves is definitely 3 00,000 kms/sec It means that with reference to light and electromagnetic waves there is no change in the value of h/c It means that as the mass of a particle increases, the wavelength decreases and as the mass of a particle decreases, the wavelength increases Here the velocity of the particle is the same therefore the frequency varies as the variation of wavelength If the wavelength decreases, the frequency increases and if the wavelength increases, the

frequency decreases And as mentioned the wavelength depends upon the mass of the particle As the mass of the particle increases the frequency also increases

According to the Jain principle, here we need to pay special attention to the fact that the mass of particles does not depend upon their own size, but upon the number of the most microscopic particles i e paramānus Therefore along with the mass of particles, their volume also should be taken into consideration If along with the increment in mass, there is corresponding increment in volume, it makes no difference at all Jain philosophical treatises show that in the space of one unit atom, there might be infinite atoms (paramānus) And as the number of paramānus (atoms) increases in the space of one unit atom, paramānus become smaller and smaller in size and thus they become denser i e their volume does not change or increase but their mass increases If the volume of photon, electron, proton neutron quark and other microscopic particles is the same, the mass of photon etc and other electromagnetic particles must vary according to the variation of their frequency It means that the transmitters transmit the waves possessing different types of frequency, really they emit microscopic particles having different masses with the velocity of 3 00,000 kms/sec in all directions This should be accepted

This is a strange fact which the common man finds difficult to understand One finds it difficult to believe that microscopic particles behave like waves This difficulty arises out of the fact that our minds are preoccupied with the knowledge of pure particles and pure waves We are familiar with the waves on the surface of water and we know the dynamics of a bullet coming out of a gun

The experimental proof of the aforesaid equation of De Broglie was arrived at in the year 1925 A D While C J Dewison-Germer performed experiment in the Bell Telephone Company, a liquid air bottle suddenly burst open and the liquid air splashed upon a red hot piece of nickel and it soiled the surface of the nickel piece Later on when they performed an experiment on that nickel piece they found that great changes had taken place in the nickel piece, On account of the accident it was converted into a single crystal and wonderful results came out of these changes It was observed that electrons were found to be acting in the form of waves and

the wavelength was equal to the wavelength in accordance with De-Broglie's formula $\lambda = h/mv$

The question therefore arose "Is an electron a wave or a particle ?" In a number of electric phenomena the electron acts in the form of a particle In a number of experiments we see its emission from the filament of the valve We can change its path with the help of electric field and magnetic field Also its path of motion in the cloud chamber can be seen clearly In the phenomenon of photoelectric effect, the electron itself acts as a particle and it also compels light to act as a particle

Thus it is definitely clear that electrons are particles

Modern physicists perform three experiments for examining the behaviour of electrons

1 The experiment with bullets of gun

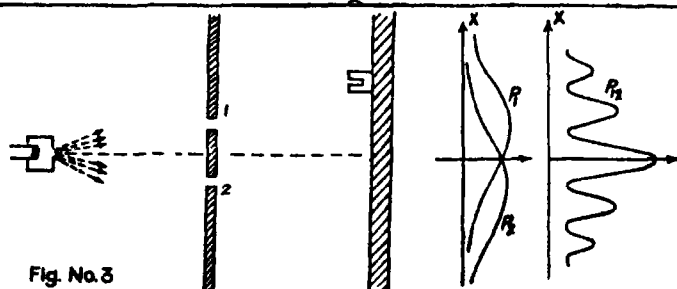
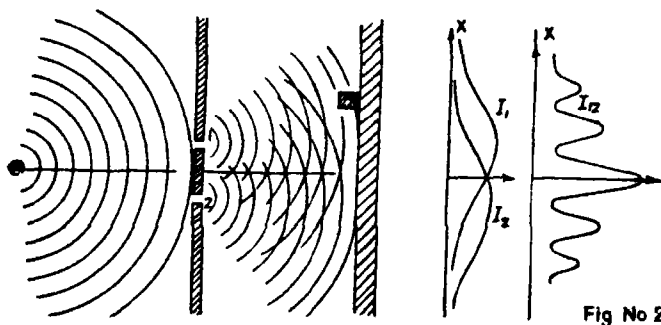
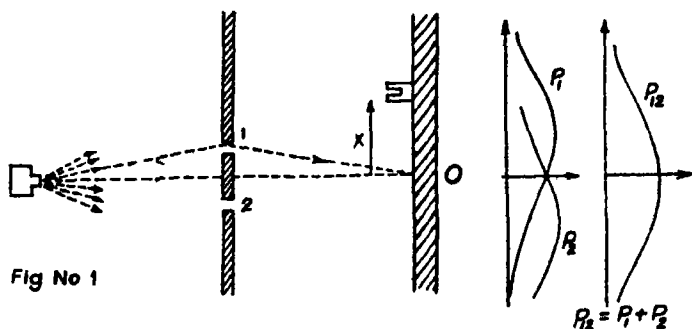
2 The experiment with waves of water

3 The experiment with electrons

In the first experiment bullets shooting from the gun at various angles pass through slits No 1 and 2 of the curtain infront of them as shown in figure No 1 Slits No 1 and 2 are so sized that a bullet can easily pass through them and after passing they dash against the wall behind On this wall there is a detector and the coming bullets are recorded with its help In this experiment a number of bullets are rapidly shot in quick succession and at enormous speed It is, therefore, not possible to observe each bullet minutely nor is it possible to notice the hole from which certain bullet passed On the basis of the principle of probability, we can determine the probability of a certain point on the wall behind at the distance X from the point O According to the principle of probability

$$\text{The probability of the bullets striking at a distance X from the point O} = \frac{\text{No of bullets coming to point X in a definite period}}{\text{Total No of bullets coming to the whole wall in the same period}}$$

This experiment is performed in three stages The experiment begins, when slit No 1 and 2 are opened The results are recorded by the graph in

fig 1C The results are wonderful Since both the slits were opened, the point of maximum probability where the bullets would strike, was not exactly in front of either slit but it was at the central point of the closed portion between the two slits

In the second stage of the experiment, slit No 1 is kept opened while slit No 2 is kept closed The results of the experiment are shown graphically by the line P_1 in fig 1B

In the third stage of the experiment slit No 1 is kept closed while slit No 2 is kept opened The results of the experiment are shown graphically by the line P_2 in fig 1B

All the three graphs in figures 1B and 1C, make it very clear that $P_{1,2} = P_1 + P_2$

A smiliar experiment can be performed on waves, created on the surface of water As shown in fig No 2, an object is placed on the surface of water for producing waves It is then oscillated upwards and downwards with the help of an electric motor The position of the object produces circular waves on the surface of the water

On the right hand side at a small distance from the object, there are two slits whose central line is attached to the surface of water Behind it there is a detector for detection of waves It can be moved in the X direction The detector fully absorbs all the waves falling upon it, and it also measures the intensity of the waves and their amplitude also This experiment *is also performed in three stages*

1 Measuring with a detector, the intensity of waves at different points, while keeping the two slits opened, we get the graph of the results as shown in fig No 2C

2 Measuring with a detector, the intensity of waves at different points while keeping slit No 1 closed and slit No 2 opened, we get the graph of results as shown by the line I_2 in the fig 2B

3 Measuring with a detector, the intensity of waves at different points while keeping slit No 2 closed and slit No 1 opened, we get the graph of results as shown by the line I_1, in the fig 2B

Graphs of single slits show similar behaviour of particles and waves, while graphs in which the two slits are opened, show that the behaviour of particles is different from that of waves

The intensity of waves $I_{1,2}$ is not obtained by addition of the waves I_1 and I_2 It means that the effects obtained from the two slits are not

independent of each other It follows that interference takes place

The experiment with electrons is as under

When electrons are emitted from the filament of the heated metal named tungston they behave like real particles After emission if they are connected with an electric or magnetic field, their direction of movement can be changed When they are detected by a detector they create pulses in the detector fig No 3 shows when the same electrons pass through slits, like bullets from the gun, they are detected in No 1, 2, 3, etc

In spite of all this, it is surprising to observe that experimental results obtained from both slits with reference to eletrons and waves are similar to each other

The experiment shows that the electron behaves in the form of a particle, when one slit is opened While it behaves in the form of a wave when two slits are opened

The question "Is an electron a particle or a wave ?" therefore, remains unsolved from the view point of modern physics We observe that in spite of being in the form of a particle the members of the microscopic world can also behave as waves This fact can provide a basis for the prospective material - particle - wave theory

Similary, the question whether light is in the form of particles or waves also remains unsolved from the view point of modern physics Such phenomena as interference, polarisation and diffraction with reference to light can be explained only by means of the wave theory, which hopelessly fails to explain the phenomena of photo-electric effect and intensity of radiation

Therefore the particle theory and the wave theory of light are both acceptable today

Regarding this Fritjof Capra makes the following statement in his book named *'The Turning Point'*

"A few years later the quantum theory made it clear that even the sub-atomic particles-the electrons and the protons and the neutrons in nucleus - were nothing like the solid subjects of classical physics

They appear sometimes as particles, sometimes as waves and this dual

nature is also exhibited by light, which can take the form of electromagnetic waves or particles The particles of light were first called 'quanta' by Einstein hence the origin of the term 'quantum theory' and they are now known as photons

"This dual nature of matter and of light is very strange It seems impossible to accept that something can be at the same time, a particle – an entity confined to a very small volume – and wave which is spread out over a large region of space "

"An electron is neither a particle nor a wave It may show particle-like aspects in some situation and wave-like aspects in others While it behaves like a particle, it is capable of developing its wave nature at the expense of its particle nature and vice versa thus undergoing continual transformation from particle to wave and from wave to particle '

Here comes to an end the history of the particle theory and the wave theory with reference to light from the view point of modern physics

Jain scriptures clearly explain this phenomenon According to them, there are six fandumental eternal elements (dravyas) namely, 1 Jīva i e the living element (Ātmā or soul) 2 Dharma i e the medium for motion 3 Adharma i e the medium for rest 4 Ākāśa i e space 5 Pudgala i e matter 6 Kāla i e Time Out of these six dravyas Dharma, Adharma and Ākāśa are formless They do not have properties of shape odour, taste, touch and colour Living together with pudgala the soul attains a concrete form But the pure soul is formless i e colourless and shapeless Jain philosophers regard Kāla (time) as a dravya and this is a distinct feature of Jain philosophy Kāla is also formless but its existence can be inferred from its functions

In short every object in the whole universe, whether it is microscopic or macroscopic, visible or invisible, perceptible or imperceptible is either a pudgala or a soul living in contact with pudgala (matter) And the minutest particles of pudgala which can never be divided into more particles in any of the three phases of time, (i e the past, the present and the future) is called a paramānu (ultimate atom) A combination of these minutest particles (paramānus) can constitute any object in the universe A pudgala has infinite energy A pure soul also has infinite energy But the great

contradiction between the two is that the energy of a soul is self-controlled, while the energy of a pudgala is controlled by a living being Every paramānu of a pudgala has colour, smell, taste and touch (tangibility) and they are the characteristics of a pudgala Whererver one experiences colour, smell etc by means of sense organs, aggregates of paramānus have to be present there Every object is essetially paudgalic (material) These objects are sometimes so insignificant that their colour, taste, smell and touch are not perceptible to sense organs, but their existence cannot be denied on that ground, e g though ultraviolet rays and infra-red rays cannot be pereceived by our eyes their effect is received on photographic plates

In the wake of progress in physics it becomes all the more significant to know whether light consists of rays or particles Are the objects known to classical physics as waves, really waves or are they particles ? If they are really in the form of particles, why is it that they behave like waves ? This needs to be explained Different types of waves – rays of visible or invisible light, sound waves of different wavelengths, ultrasonic waves of very high frequency and infrasonic of very low frequency, which are not audible and electromagnetic waves of different frequency and different wavelengths, which are useful in broadcasting radio signals and television signals and signals of other transmitters are known to classical physics Are all these rays in the form of waves or particles ? This is a very important question of modern physics and we shall try to find its solution

Jain scriptures state that Śabda (sound), Andhakāra (darkness), Udyōta (coolling, soothing light i e moonlight), Ātapa (hot light i e sunlight), Prabhā (irregular spread reflection, interference etc of light) are modifications of prime matter All the aforesaid phenomena are constituted of microscopic particles (paramānus) of matter In the fifth chapter of Tattvārtha Sūtra, Umāsvāti while defining pudgala (the prime matter) says - pūrayanti galayanti iti pudgalāh (पूरयन्ति गलयन्ति इति पुद्गला) In pudgala (the prime matter) the process of splitting i e fission and combination i e fusion of particles is ever going on No object remains in the same condition forever e g There are billions of cells in our body Lakhs of them are destroyed every moment and they are replaced by nearly as many newly created cells

In atomic physics the process of fission and fusion is the best examples

of splitting and combination of particles Both these processes need energy In certain circumstances fusion produces atomic power and in others fission produces atomic power

Uranium, radium etc used in atomic process emit three types of rays namely alpha (α), Beta (β), and Gamma (γ) These rays are nothing but shower of particles of a particular kind An oscilloscope produces their trace on the screen Particles of alpha rays are like nuclei of Helium atoms, Beta rays contain electrons and Gamma rays are like particles of light and as we have seen the rays of light are also forms of particles which are called photons

The description of types of paramānu-units in Jain scriptures also support this theory There are infinite types of Varganās in the universe but there are only eight classified types of Varganās which are useful to living beings Their names are as under

1 Audārika Varganā 2 Vaikriya Varganā 3 Āhāraka Varganā 4 Taijas Varganā 5 Bhāsā Varganā 6 Śvāsōcchvāsa Varganā 7 Manō Varganā 8 Kārmana Varganā

Varganā' are groups of paramānus and each unit of it has a certain paramānus number Paramānu-units of Audārika Varganā possesses infinite number of paramānus- All fundamental particles such as eletron, proton, neutron, positron, neutrino, quark and so many others that scientists have discovered belong to the Audārika Varganā

Of the eight types of Varganās we here confine our discussion to Taijas Varganā and Bhāsā Varganā Different types of electromagnetic waves and light waves are paramānu-units of Taijas Varganā and sound waves are paramānu-units of Bhāsā Varganā

More description and explanation is given in Jain tretises like कर्मप्रकृति, पञ्चसङ्ग्रह, आचारागटीका etc

It is very pertinent here to study how sound is created and how it propagates in the universe The fourth chapter named Bhāsā-Jāta of the second part of the Ācārānga, the sacred Jain Āgama (canonical book) states that sound (Bhāsā) has four varieties

1 Utpatti-Jāta, 2 Paryava-Jāta 3 Antara-Jāta and 4 Grahana-Jāta

1 A living being takes paramānu-units of Bhāsā Vargaṇā and releases those after converting them into words Bhāṣā This is called Utpatti-Jāta

2 If paramānu-units of Bhāsā Vargaṇā released according to the above-mentioned process collide with other paramānu-units of Bhāṣā Vargaṇā that are in a order or disorder of series around the source of sound and convert them into sound, this newly converted sound is called Paryava-Jāta

3 If paramānu-units of Bhāsā Vargaṇā released according to Utpatti-Jāta process, collide with other paramānu-units of Bhāṣā Vargaṇā that are in a series around the source of sound and convert them into sound, these newly converted paramānu-units of sound are called Antara-Jāta

4 Whether they are in an order of series or in a disorder of series some of the paramānu-units of Bhāsā Vargaṇā get converted into sound and then they enter the hole of the ear and affect the hearing centre in the mind They are called Grahana Jāta

These paramānu-units, called Grahana Jāta have infinite space-points (pradēśas) (One pradēśa means the volume of space occupied by a single separate paramānu) They occupy space consisting of innumerable pradēśas The life-span of these paramānu-units consists of countless SAMAYAS In Jain philosophy SAMAYA is the extremely minute unit of time Even though it seems impossible to calculate how many SAMAYAS make a second, Śrī Nandlal Jain has calculated that one second contains approximately a minimum number of 10^{380} to 10^{500} SAMAYAS These paramānu-units have different types of colour, smell, touch and taste

Paramānu-units of sound that do not enter the ear, dissolve either in the original paramānu-units of Bhāsā Vargaṇā or into other types of paramānu-units

The modern well established classical physics fully accepts the theory that sound is in the form of waves But according to the logical viewpoint of Jain philosophy, sound is composed of particles

The propagation, reflection, defraction, interference and other phenomena of sound being the subject-matter of a separate research article, we do not discuss them here

We return to our original question whether light and electromagnetic waves which have a velocity 3,00,000 kms/sec are absolutely in the form of waves or particles

Max Planck says that energy (light) is emitted in the form of quanta but it propagates in the form of waves Einstein states that emission and propagation of light are both in the form of quanta He calls them photons

As a matter of fact, light is composed of minute particles and it propagates in the form of particles According to Jain philosophy, even photons are composed of infinite and extremely microscopic particles i e paramānus When they propagate, they rotate like a cricket ball or a ball-bearing Those who play or watch the game of cricket, know that the bowler continuously polishes one side of the ball to make it smooth And there is a scientific reason for it Being polished the surface on one side of the ball becomes smooth, while the surface on another side of the ball is comparatively rough When the bowler throws this ball, air passes fast by the smooth surface and less friction is produced and so the resistance of air decreases But air passes slowly by the rough surface and more friction is produced and so the resistance of air increases On account of unequal resistance, the ball diverts to the direction of greater resistance The bowler throws inswinger and outswingers There are inswing and outswing types of bowling in cricket

Similarly since photons are composed of innumerable paramānus, when they propagate with a velocity of 3,00,000 kms/sec they resist other particles which are more microscopic than photons and therefore, they again and again divert from their original path into two opposite directions and they seem to behave like a wave Their diversion is caused by unequal (smooth and rough) surfaces and resistance Unequal mass can also cause their diversion If there is greater mass on one side and less mass on another side of photon particles, they can behave like a wave

Thus though light and other electromagnetic waves are in the form of particles, they seem to propagate in the form of waves The distance between the two points in a straight line where light particles divert from its path in same side is called wavelength The distance of displacement of photons on two sides of its original straight path is called amplitude

The number of diversions of a photon from its straight path in one second is called its frequency

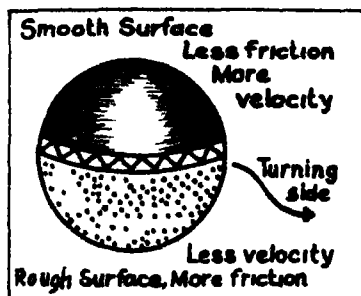
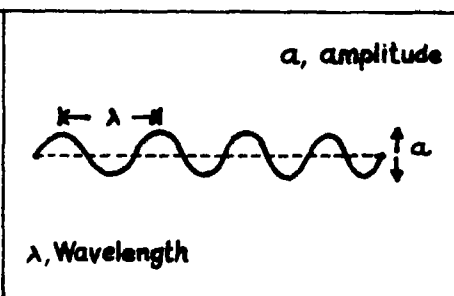



Fig No 4 Fig No 5

Frequency wavelength and amplitude of light waves depend on types of photon differing, according to the number of paramānus, they have

Photons of all types of visible and invisible light rays may be considered as the Taijas Varganā Taijas means light or electricity Since all electromagnetic waves are created with electricity, they also belong to Taijas Varganā And where there is electricity, there are positive and negative electric charges An electric current gives rise to magnetic field when it passes through steel In short electricity and magnetism are so closely interconnected that they cannot be separated

Paramānu-units of all electromagnetic waves may be considered as Taijas Varganā, while paramānu-units of all sound waves, may be considered as Bhāsā Varganā

Sound waves bend because paramānu-units of Bhāsā Varganā have a very low velocity of 330 metres/sec Light waves and electromagnetic waves having velocity as high as 3,00,000 kms/sec do not bend because particles of light (photons) and those of electromagnetic waves can propagate through atmosphere and outer space consisting of paramānu-units which consist of particles of smaller size and less mass

Though the paramānu-units of Bhāsā Varganā are useful for propagation of sound, they consist of many more paramānus then the units of Taijas Varganā or units of electromagnetic waves Since the velocity of particles of units of Bhāsā Varganā is 1 1 x 10 [illegible] times less than that of photons,

when propagating particles of Bhāsā collide with other paramānu-units of Bhāṣā Varganā, and convert them into sound and get reflected When the velocity of paramānu-units of sound rises, with the help of electromagnetic force to the velocity of electricity, paramānu-units of sound, too, propagate in a straight direction

On the basis of all these scientific facts and on the basis of physics discussed and described in Jain scriptures, we can conclude that paramānus dominate the whole universe and these microscopic particles while retaining their particle form can behave like a wave Contrarily to what Fritjof Capra says, their waveform is not created on destruction of their particle form nor does their particle form come into existence on destruction of their wave form In short, when they are stationary, particles are in the form of particles When they propagate they are perceived like a wave But the wave form of particles can be never seen

I end this paper with an appeal to research scholars to explore the vast ocean of precious gems of knowledge lying hidden in oriental scriptures and assimilate them with modern science in the larger interest of human welfare

THE CONNECTION BETWEEN PHYSICS AND MYSTICISM IS NOT ONLY VERY INTERESTING BUT ALSO EXTREMELY IMPORTANT MYSTICISM IS, ABOVE ALL, AN EXPERIENCE THAT CANNOT BE LEARNED FROM BOOKS

FRITJOF CAPRA

4. Intensity Of Light

With regards to light as generally believed by all scientists, we also accept that the intensity of light depends upon the number of photons

Intensity of any kind of radiation depends upon the number of incident particles i e photons per unit area per unit time As the distance between the source of light and light receiving surface increases, intensity decreases with a proportion to be reciprocal of the distance square because the number of photons received by that surface decreases It is denoted as follows

$I \propto 1/d^2$ {Where I is intensity and 'd' is distance between source of light and light receiving surface}

$I = K/d^2$ {Where K is constant for the same source of light and it denotes total number of photons per unit time emitted by a source and it depends upon emissive power of the metal}

$I = \frac{n}{t} \times \frac{1}{d^2}$ (K=n / t n depends upon emissive power and light-velocity $n = e\sigma c$)

$I = \frac{e\,\sigma c}{t\,d^2}$ (Where e depends upon an area of emitting surface, σ = *Nandighosh* constant and its unit may be joule sec/meter c = velocity of light d = distance between the source of light and light receiving surface)

But photons are scattered in all directions, the number of photons per unit area decreases with proportion to $1/4\pi r^2$ Here r = d

$$I = \frac{e\,\sigma c}{4\pi t d^2} \; OR \; \frac{e\,\sigma c}{4\pi t r^2}$$

If either a source of light or a light receiving surface is in motion and they come nearer to each other, their velocity becomes negative then r = d-v t, where d is an initial distance between the source of light and light

receiving surface And if they go far apart from each other then $r = d+v\,t$

$$I = e\,\sigma c/4\pi t\,(d \pm v\,t)^2$$

This formula can be used only for direct light but not for reflected and concentrated light Doppler's effect can easily be known by this formula

In this formula 'e' does not depend only upon the area of light emitting body but it also depends upon the specific resistance of metal , length of filament and area of a cross section of the filament and it can be determined from the following formula of electricity

In electricity, intensity of light depends upon the watt of a bulb e g Light intensity of 40 Watt bulb is more than 25 Watt bulb, in the same way light intensity of 60 watt bulb is more than that of 40 watt bulb In short as watt increases intensity increases

But $W=I^2 R$ (Where W = watts I = current in amp and R=Resistance in ohms) and $R = \delta\, l/a$ (Where R= Resistance, δ = Specific Resistance of metal, l = length of filament in cms , a=area of a cross section of filament in square cms)

Suppose in case of electric bulbs of same company a specific resistance of tungston metal and area of a cross section of the filament might be same forever then R, resistance is directly variable with length of filament Therefore as length of filament increases resistance increases and with the increment in length of filament watt also increases, if there will not be any change in current I But, in practice, it is not possible

Absolute temperature has not been considered here because, it affects only on the frequency of each photon

5. New Concepts About Doppler's Effect

Indian philosophical treatises are composed by ancient saints with minute and extra-sensory knowledge, which are completely scientific and true More than 2500 years later they are able to give a solution of modern scientific problems

According to Jain philosophy sound, darkness, light, shadow, and aura are absolutely the modifications of matter And according to Jainism the most micro and completely indivisible particle of matter is called atom Though the definition of atom in modern physics and in oriental philosophical scriptures is the same yet their concepts are quite different from each other

Oriental concepts about light and sound are able to solve all difficulties or problems of modern physics

Today, I am mentioning new concepts about Doppler's Effect in case of light

According to Special Theory of Releativity, Einstein gave a formula for the frequency of moving luminous objects as follows $f' = f\frac{1 - Cos\theta v / c}{\sqrt{1 - v^2 / c^2}}$

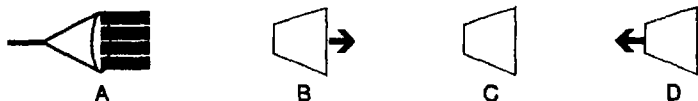
Where f' denotes resultant frequency for moving bodies, f denotes frequency when the body is at rest, v and c are the velocities of moving bodies and light respectively

This is Doppler's principle for all velocities When $\theta = O$ the equation assumes the perspicuous form $f' = f\sqrt{\frac{1 - v/c}{1 + v/c}}$

If here velocity of source of light is $-c$ i e $v = -c$, it means ray of light and source of light have equal velocities in the forward direction Then

$f' = \infty$ and hence according to $E = nhf$, energy becomes infinite and wavelength becomes zero

And if $v = c$, i e the source of light and the light-approached the surface go far apart from each other with a velocity c If the approaching surface is steady then the source of light goes far and far from it Therefore according to the equation $f' = f\sqrt{\frac{1 - v/c}{1 + v/c}} = f\frac{0}{\sqrt{2}} = 0$ the resultant frequency becomes zero, wavelength becomes infinite and energy beomes zero i e photon will remian steady or motionless

Suppose for the Doppler's Effect, the situation is as follows

A is a source of light which is steady and B, C and D are the objects from which B has velocity $+v$ i e it goes far from source of light A with a velocity v, C is steady and D has velocity $-v$ i e it comes nearer to the source of light

Now according to Einstein's equation, frequency of the same photons of the same source of light is different for B, C and D objects For the object B frequency of photon decreases, while for the D object frequency of the same photon increases at the same time for object C, it remains constant, What a strange situation it is !

Though this is mathematically true yet in practical life and logically it is not appropriate or proper

Actually in Doppler's Effect frequency or the energy of each photon remains the same forever It is not variable according to the velocity of either source of light or light approaching surface because the source of light emits photons which have always equal or the same energy and the frequency is either steady or it moves in the forward or the reverse direction

Intensity of light or any radiation depends only on the number of photons approaching the unit area of surface per unit time And therefore the velocity of either the source of light to the approaching surface or the approaching surface to the source of light increases the intensity of that light And if they are going far apart from each other, intensity of that light

decreases because the number of photons per unit area per unit time decreases

A total energy per unit area does not only depend upon frequecny of each photon but also it depends upon number of photons per unit area per unit time Hence, if intensity increases total energy also increases

Actually in modern physics, according to Jainism (Jain philosophy) and according to my opinion, frequency is absolutely imaginary Only the particles of sound or light or electromagnetic waves travel in space and their path is serpentine or zig-zag When they are at rest, there is no frequency, no energy Only when they are in motion, they have imaginary frequency depending on their serpentine paths and energy depending on their velocity, that might be equal to Newtonian Mechanics $K\,E = \frac{1}{2}mv^2$ or $\frac{1}{2}mc^2$ Where m is the rest mass of photon Though scientists of modern age believe that photon has zero rest mass yet in calculation of momentum $p = mv$, ($p = mc$), they consider that a photon has rest mass

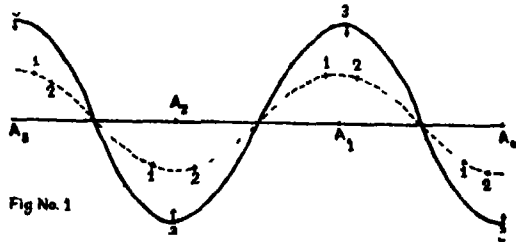
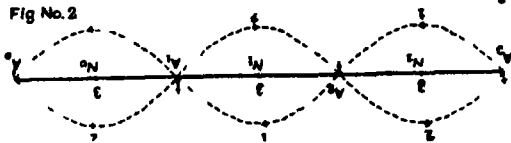
Photoelectric effect also proves that the photons are in the form of the most micro particles And the following words of the scientists G Heber and G Weber say that a photon can be divided into 1 electron and 1 positron

> *We only mention the transformation of a photon into 1 electron and 1 positron, the reciprocal process, the manifold transformations among the mesons and transformations from mesons to electrons photons and neutrons "*

Solar deflection of star light is also able to prove that photons have some mass

6. New Concepts About Interference of Light

In modern physics, the phenomenon of interference has unique importance and according to the opinion of scientists of modern age it could be explained only by the acceptance of the wave theory of light On the other hand, the phenomenon of photoelectric effect could be explained only with the help of the corpuscle theory or the particle theory Hence all the scientists of modern age accept the dual nature of light and they also believe that the subatomic particles like electrons, protons, neutrons etc also have a dual nature, similar to that of light

On the other hand Jain physics or Jain philosophy absolutely accepts light in the form of corpuscles and according to my opinion it is absolutely true Therefore, in this article, I give an explanation of the phenomenon of interference of light with the help of the corpuscle theory only Of course, when light, all the electromagnetic waves and also all subatomic particles, propagate in space, their path is serpentine or zigzag simmilar to that of waves Thus there is no difficulty about acceptance of the corpuscle theory of light

P D $= 0, \lambda, 2\lambda$

P D $= \frac{\lambda}{2}, \frac{3\lambda}{2}$

According to the wave theory of modern physics, when two waves from coherent sources superpose each other, the phenomenon of interference takes place In this phenomenon if the path difference between the two

waves, that are superposed on each other is 0, λ, 2λ, 3λ, $\eta\lambda$ then the crest of one wave falls on the crest of the other wave and also trough of one wave falls on the trough of the other wave and as a result constructive interference takes place If the path difference between two waves is $\frac{\lambda}{2}, \frac{3\lambda}{2}, \frac{5\lambda}{2}$ $(2\eta-1)\frac{\lambda}{2}$ then crest of one wave falls on the trough of the other wave and in same way the trough of one wave also falls on the crest of the other wave and as a result destructive interference takes place

According to modern physics the intensity of light or waves depends upon the amplitude of waves It is directly proportional to the amplitude i e If amplitude (a) increases, intensity increases and if amplitude decreases, intensity also decreases In the phenomenon of constructive interference, amplitude of resultant wave on account of superposition of one wave on another wave becomes double, and intensity of a wave is directly proportional to the square of its amplitude

$I \propto a^2$ (I denotes intensity, a denotes amplitude)

$I' \propto (2a)^2$ (I' denotes resultant intensity)

$I' \propto 4a^2$

$I' = 4\,I \;(\because a^2 = I)$

According to this equation the intensity of the resultant wave in constructive interference becomes four times greater than the original single wave intensity and it is the maximum intensity of resultant wave

While in destructive interference the resultant amplitude of the resultant wave becomes zero, hence the resultant intensity also becomes zero

In Young's experiment, there is an illuminated slit in screen A as shown in fig, No, 3 which emits spherical waves In the second screen there are two slits having equal distance from the slit of first screen A They act as the coherent sources The waves, having the same frequency, the same amplitude and the same wavelength, passing through both slits S_1 and S_2 superpose each other and produce interference In fig, No 3, dark lines show the crests of both waves coming from slit No 1 and Slit No 2 While dotted lines show the troughs of both waves, coming from both slits We can see from the figure that when a crest of one wave falls on the crest of the other wave or a trough of one wave falls on the trough of the

other wave, a constructive interference takes place and both are denoted by small circles In the same way when the crest of one wave falls on the trough of another wave or a trough of one wave falls on the crest of the other wave, destructive interference takes place and both are denoted by dark points By putting a screen in the path of these superposed waves, we get bright fringes on the screen in the straight lines of small circles showing constructive interference of light and dark fringes on the screen, in the straight lines of dark points showing destructive interference

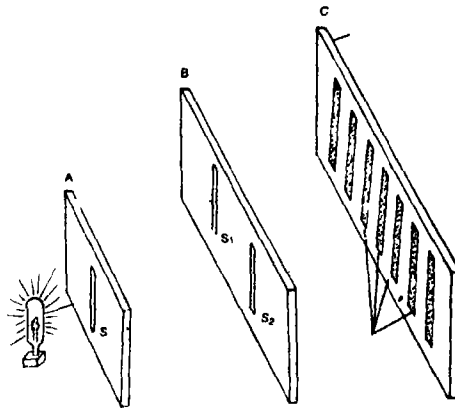
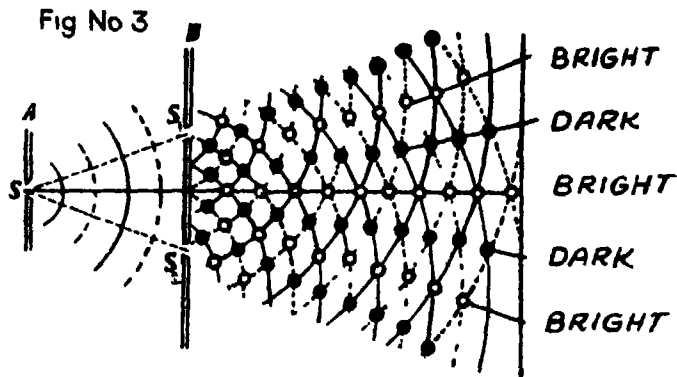



Fig No 3

Fig No 4

Now I am giving an explanation of interference, with the help of corpuscle theory according to Jainism

In the phenomenon of interference when both the slits are opened, the photons pass through both the slits in very large numbers simulteneously i e at a same time According to the wave theory when along straight lines of interactions of crest with crest and trough with trough of both waves created by both slits, bright fringes are formed on the screen and along straight lines of interactions of crest with trough and trough with crest of each other, dark fringes are formed as shown above

When the crest of one photon interacts the crest of another photon or a trough of one photon interacts a trough of another photon, there is a collision between the photon particles that are coming from two separate slits at the same time with the same frequency amplitude and wavelength Hence after collision, both photons propagate in the direction of resultant vector according to the law of parallelogram It is denoted by the following equation

$\vec{e} = \vec{E}$ Sin (ωt - Kr), where $K = 2\pi / \lambda$ is a wave vector Of course both the photons have the same energy and the same mass after and before the collision and they do not interact with each other and therefore only the intensity of light increases Law of conservation of mass, energy and momentum can also be applicable to this phenomenon, though scientists believe that photons have no mass

While in the interactions of the crest of one photon with the trough of the second photon or a trough of one photon with the crest of the second photon, both photons do not collide with each other and they pass through without changing the direction of the other photon But these same photons change their directions, when their crests fall on the crests of other photons or their troughs fall on the troughs of other photons As a result along the straight lines, showing the interactions of the crest of one photon with the trough of the other photon, photons will be absent and, therefore such type of interactions form the fringes of darkness

As aforementioned, according to modern physics, intensity of light in constructive and destructive interference depends upon the amplitude of the resultant wave In case of constructive interference it becomes four

times greater than the original single wave and in destructive interference it becomes zero According to Jain physics as I have shown in the articles 'Intensity of Light' and 'New Concepts About Doppler's Effect', intensity of light depends only upon the number of photons per unit area, per unit time Here, in the constructive and destructive interference, it is applicable

According to modern physics a distance between two consecutive bright fringes is $\bar{x}=\frac{\lambda D}{d}$ and a distance between two consecutive dark fringes is also $\bar{x}=\frac{\lambda D}{d}$ It means that the area in which the photons are incident becomes half the original area and all the photons coming from both slits, fall on this half area Hence the number of photons become double and area becomes half As a result the number of photons per unit area per unit time becomes four times greater than that of a single wave coming from any single slit

Here the intensity of bright fringes formed due to constructive interference becomes four times greater than the intensity of single wave coming from the single slit and the intensity of dark fringes becomes zero due to destructive interference

Thus the most important phenomenon called interference can be interpreted with the help of corpuscle theory only

THE GENERAL NOTIONS ABOUT HUMAN UNDERSTANDING WHICH ARE ILLUSTRATED BY DISCOVERIES IN ATOMIC PHYSICS ARE NOT IN THE NATURE OF THINGS WHOLLY UNFAMILIAR, WHOLLY UNHEARD OF, OR NEW WHAT WE SHALL FIND IS AN EXEMPLIFICATION, AN ENCOURAGEMENT, AND A REFINEMENT OF OLD WISDOM

JULIUS ROBERT OPPENHEIMER *SCIENCE AND THE COMMON UNDERSTANDING* P 8-9

7.Black-holes: Imaginary Ideas Of Their Structure

In the boundless universe our earth is nothing more than a mere point For those who live on the earth, the earth is, however, their all in all Man's curiosity is so strong that since centuries he has been making efforts to know the earth, its location and importance with reference to the whole universe As new researches are made in science, various kinds of new problems arise Sometimes they make the structure of the universe more complex rather than simple and more confusions are created [1]

Through the progress of the modern physics, through its modern instruments and through the radio telescope (whose function is to find out unfamiliar space objects moving in the boundless space and give information about their structure), the horizons of astrophysics go on expanding With their expansion, it is now high time, we dismissed the old concepts of Einstein

According to the modern physics, there are three main elements in this universe 1 Space, 2 Time and 3 Matter They alone are thought of everywhere in the physics Of course, he who thinks of these elements is himself an important constituent element of the universe In Jain terminology, it is called the living element, soul But no thought is given to it in the physics because it is non-materialistic The physics has not been able to give any definite description of it or to make any research on it Therefore, it has been kept aside, In the whole universe, search is being made for matter

Nearly in the decade 1971 to 1980 A D an influence was drawn with the help of a radio-telescope that there wereblack-holes in the distant deep regions of the universe because from a particular direction, some special kinds of signals were received on the radio-telescope But with the help of the usual powerful telescope, nothing except a black point was seen in the region The scientists, therefore, named the black point which was the source of the signals received on the radio-telescope, as the black-hole and they started making inferences about its structure Of course, they made the inferences according to the principles of the physics

For the common man, the structure of the black-holes was very impressive Even so, the black-holes were for them nothing more than a mere imaginary science fiction, a cosmic picture-story or a newish subject-matter of making feature-films

Modern scientists believe that the black-holes have a very strong gravitational force and even light cannot escape from their gravitational force and that is the reason why they cannot be seen

This inference of scientists is based on scientific principles and their mathematics [2] According to their inference, stars which have as much mass as nearly ten times the mass of the sun of our solar system and which are in very distant and deep regions of the boundless universe become supernovae at the end of their life-span In other words when they cannot bear their own internal pressure - attraction and repulsion - they burst out with a tremendous explosion and then on account of tremendous pressure of their own gravitational force, they go on contracting and became so small that compared to the whole universe which is as expansive as thousands of millions of light-years, their volume is reduced to the point of negligibility The volume of the stars having as much mass as ten times the mass of the sun of our solar system is reduced to the diameter of only 60 kilometres [3] For that reason its gravitational force rises tremendously and it soon begins to attract all the surrounding objects to itself and gulps down all that comes to it It again absorbs even the light emitted by the same supernovae i e itself As an object, a stone, a ball etc tossed from the earth, returns to the earth, to the centre of the earth by its gravitational force, so the light emitted by the contracted supernovae star, is again absorbed in the centre Moreover, it does not allow the reflection of the light that falls on it from other external illuminated objects As a result, those stars cannot be seen Only something like black points are seen in the direction That is the reason why they are called black-holes

We are all familiar with the concept of escape velocity, i e velocity to escape from gravitational force If a small stone is tossed from the surface of the Mars to the phobos the satellite or moon of the Mars with the force and velocity with which it is tossed from earth-surface to space, it reaches its orbit or goes up 9000 kilometres high in the orbit of the phobos, the satellite of the Mars and become a satellite of the Mars because the gravitational force of the moon phobos of the Mars is so slight that there, the velocity to escape from

its gravitational force, is only 5 metres/sec [4]

If an artificial satellite of the earth which is set moving in space, moves only at the velocity of 8 km/sec , the centripetal gravitational force and centrifugal force caused by the velocity of the artificial satellite can counter-balance and the satellite can keep moving in the orbit [5] Otherwise, it is attracted downwards by gravitational force of the earth This applies to artificial satellites set in the lower orbit

But if, for example, a motor-cyclist increases his speed beyond a certain limit he can make his motor-cycle jump from one bank of a river to the other Similarly, if the speed of rocket carrying a satellite in space, rises to a certain limit or beyond it, it can get free from gravitational force of the earth The minimum velocity required for getting free from gravitational force of the earth is called escape velocity For the objects on the earth, it is at least 11 2 km/ second This escape velocity of any planet, star or space object can be easily calculated [6]

The escape velocity of our moon, is 2 4 km/sec The escape velocity of the sun is 620 km/second The stars which have a greater density and are known among scientists as white dwarfs have escape velocity of thousands of kilometres per second [7]

As the mass of space object increases, its escape velocity increases It is also necessary to note that if the mass is constant the escape velocity of a space object with a smaller radius or diameter is greater than the escape velocity of space object with a greater radius or diameter In short, the mass being constant, the escape velocity of a space object increases as its radius becomes smaller [8]

It is on the basis of this plain and simple, intelligible principle of escape velocity that modern scientists make inference about black-holes and explain them It is since the time of observation of the satellite of Jupiter made by Olaiis Roemer in 1676 A D that the velocity of light believed to be 3,00,000 km/sec It is therefore, very easy to guess that some stars/objects in space have such a great mass that on their surface, their escape velocity is greater even than the velocity of light [9]

In his article which John Michell presented to the Royal Society in 1783 A D and which was later published in the Philosophical Transection, he wrote

that if the density or mass of the sun is kept constant and if its diameter is halved, it is reduced to 500th part of its size In these circumstances, if an object is sent to the sun from infinite distance, it gains a greater velocity even than light before it reaches the surface of the sun As a result, light is also attracted to the sun with the same force and all the light emitted by the object is again absorbed by it by force of gravitation Later on, only after a few years, in 1796 A D Pierre Simon, the mathematician and astronomist and Marquis de Laplace made a similar note in their essay entitled *'Exposition due System du monde '*[10] It means that the inference regarding black-holes was made 200 years ago But these concepts of Michell and Laplace were altogether forgotten till Einstein searched and developed his General Theory of Relativity because nobody knew about this kind of contraction of physical objects in space and on the other hand, the inference of black-holes was based only on the Newton's principle that light is constituted of material particles Contrarily, Newton's theory of particles with reference to light came to be rejected and scientists accepted wave-form of light Moreover, they accepted that gravitational force of an object had no effect on light-waves, whereas the effect of gravitational force was the main thing in the concepts of John Michell and Laplace

In 1911 A D when Einstein was a Professor in the Prague University, he for the fist time, calculated the effects of gravitational force of space objects on light-waves In 1914 A D at the time of the total solar eclipse, Einstein tested the results, he had obtained But since the first World War declared in those days, the subsequent research work had to be cancelled It was good for Einstein because Einstein's theory at that time was not sound and his calculations were also faulty [11]

But in the weekly 'Berliner Berichte' published on the 4th, the 11th, the 18th and the 25th of November, 1915 A D , Einstein fully explained the 'General Theory Of Relativity '[12] According to the General Theory Of Relativity, on account of gravitational force of space object like the Sun which have a tremendous mass, their surrounding space contracts and curves and that is why the ray of light that passes near by it, attracts towards that massive object i e it slightly deflects from its straight path This is called Solar Deflection of Star-light

In short, the tremendous gravitational force of the sun has an indirect effect

on the rays of light of distant stars This is what Einstein said On 29th May, 1919 A D at the time of the total solar eclipse, the deflection of rays of light passing by the sun near Sobral in Brazil was measured and it accorded with calculations shown by Einstein [13]

Einstein announced his research in November, 1915 A D Only a month later Karl Schwarzchild, the German Physicist calculated the area of the gravitational force of a globe in vacuum [14] And on the basis of it, the idea of invisible stars presented by Michell and Laplace in 1796 A D again enthused scientists

Space objects which have a greater mass than that of our sun, can be divided into three categories Some objects contract and become white dwarfs Some objects become neutron stars and some become black-holes

Dr Subramanyam Chandrashekhar, the Indian astrophysicist, presented a research paper in 1931 A D and stated that since the objects which have a greater mass than 1 4 M_O (1 4 solar mass), cannot bear their own internal gravitational force, they begin to contract and are reduced to a small bright star which is called a white dwarf The white dwarf has no greater mass than 1 4M_O and in size it is almost as big as the earth [15] But neutron stars are very small and sometimes they are of a diameter of only 20 kilometres [16] Regarding the mass of neutron stars, there are different beliefs According to some it has a mass of 0 7M_O at the most According to others, a neutron star has a mass of 2 2$M_O$at the most According to Shipman, it has a mass of 3 0 M_O at the most [17]

According to some, objects which have a mass up to 10 M_O become supernovae contract and are changed into black-holes According to some, stars with a mass of 10 M_O are changed into neutron stars Before it becomes a black-hole, the mass of the star is greater than 3 M_O and its extreme size is as big as that of a Neutron Star [18]

The ancient history has also recorded some supernovae events In the present times also, while Ian Shelton, the astronomer was observing space from his observatory at Las Companas, he saw a star becoming supernovae in the direction in which he was making observation This supernovae was seen in the galaxy known as Magellanic Cloud By a telegram he immediately communicated this to the International Astronomical Union [19] This is the first

recorded case of a supernovae seen with a naked eyes The supernovae star itself contracts in course of time and becomes a black-hole

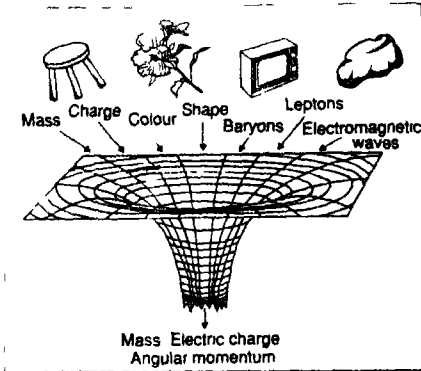



Figure 1 The black hole remembers only the mass angular momentum and electric charge of the matter which falls into it (After Ruffini and Wheeler)

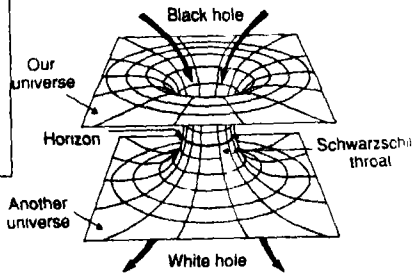



Figure 2 Embedding of Schwarzschild space time
The Schwarzschild throat connects our universe (upper sheet) with another universe (lower sheet)

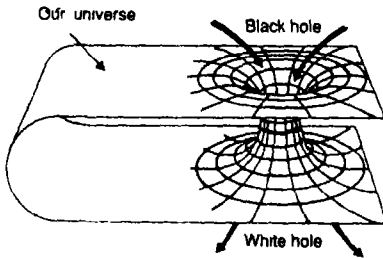



Figure 3 Identifying the sheets
The two sheets of the Schwarzschild throat can be interpreted as two different regions of the same universe For this the two sheets are connected at a great distance from the throat The diagram cheats by flattening the sheets whose usual shape would be paraboloidal

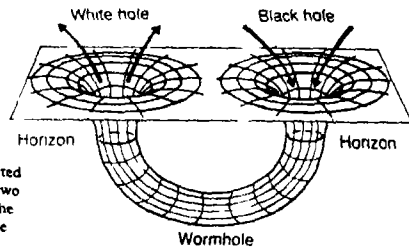



Figure 4 A wormhole in space time
This is the unfolded version of the preceding diagram The horizons of the black hole and the white hole have been separated and are linked by a wormhole

Thus scientists hold different view regarding the structure of black-holes created in imagination The structure of black-holes is believed to be according to the four different figures shown below

Why do astronomers make such a deep research work on black-holes? Hundred of such blackholes are there in our solar system and outside the galaxy at a distance of hundreds of light years We are not to obtain anything from them In their heart of hearts, scientists have a hope that these black-holes are an inexhaustible treasury of energy and in future that energy may be useful to the earth Of course, this is only an imagination but scientists hope that some time even this imagination will turn into reality Here a principle of physics is at work It is that in the whole of the universe, there is a definite quantity of matter and energy It is never reduced It is always constant Therefore, the objects that go into black-holes and get destroyed must undergo some transformation and according to the equation shown by Einstein energy must be obtained through the destruction of the objects (Fig No 1)

But according to the researches that have been made, this does not happen Some scientists, therefore, think that at the other end of the black-holes,there must be a counter universe (Anti-universe) which is similar to our universe and we invisibly conceive to The objects gulped from our universe through the black-hole, are obtained across the white hole in a new form (Fig No 2)

There are some who believe that the black-hole and the white hole are two divisions of one and only the one universe that we belong to And, therefore, the universe towards us, to this side of the black-hole and the universe towards that side of white hole are very distantly connected as shown in Fig No 3 Some scientists believe that the black-hole and the white hole are on the same horizontal level and they are connected by the wormhole They also believe that our solar system, galaxy etc lie between them or in some other region outside them (Fig No 4)

The neutron star shown above has a density[20] generally varying from 1 tonne/cm^3 to 4,00,000 tonnes/cm^3 and the area of the circular black-hole is 5650 sq kilometres and near its surface its gravitational force is 1500 crore times greater than the gravitational force on the earth [21] But the weight of the smallest black-hole is 10^{15} grams and its size is only as big as that of a proton at the centre of its atom [22]

Some modern Jain scholars believe that the black-hole is the kṛṣnarāji and

Tamaskāya (embodiment of darkness) described in the Jain scriptures such as the Sthānānga Sūtra, the *Brhatsēgrahanī*, the *Brhatkṣētrasamāsa* etc Of course, Jain scriptures give description of the structure which is the same as or largly similar to the description of the structure of the black-hole which the modern scientists give In the Sthānānga Sūtra, we get the following reference to the Krsnarāji

उप्पि सणकुमारमाहिदाणं कप्पाण हेट्ठि बभलोगे कप्पे रिट्ठविमाणे पत्थडे एत्थ णमक्खाडग समचउरससंठाणसठितातो अटठ कण्हरातीतो पन्नता तं जहा - पुरच्छिमेण दो कण्हरातीतो, दाहिणेण दो कण्हराइओ पच्चच्छिमेण दो कण्हराइओ, उत्तरेणं दो कण्हराइओ, पुरच्छिमा अब्भतरा कण्हराती दाहिणं बाहिर कण्हराइं पुट्ठा दाहिणा अब्भतरा कण्हराती पच्चच्छिमगं बाहिर कण्हराइं पुटठा, पच्चच्छिमगा अब्भतरा कण्हराती उत्तरं बाहिर कण्हराइ पुटठा, उत्तरा अब्भतरा कण्हराती पुरच्छिम बाहिर कण्हरातीं पुटठा पुरच्छिम पच्चच्छिमिल्लाओ बाहिराओ दो कण्हरातीतो छलसातो उत्तरदाहिणाओ बाहिराओ दो कण्हरातीतो तसाओ सव्वाओऽवि णं अब्भतरकण्हरातीतो चउरंसाओ १। एतासि ण अटठण्ह कण्हरातीण अटठ नामधेज्जा पन्नत्ता, त जहा - कण्हरातीति वा, मेहरातीति वा, मघाति वा माघवतीति वा वातफलिहेति वा, वातपलिक्खोभेति वा, देवपलिहे वा देवपलिक्खोभेति वा २ । एतासि ण अट्ठण्हं कण्हरातीणं अट्ठसु उवासतरेसु अट्ठ लोगतितविमाणा पन्नत्ता, त जहा अच्ची, अच्चिमाली, वतिरोअणे पभंकरे चदाभे, सूराभे, सुपइटठाभे अग्गिच्चाभे ३ । एतेसु ण अटठसु लोगतितविमाणेसु अटठविधा लोगतिता देवा पन्नत्ता, त जहा - सारसतमाइच्चा वण्ही वरुणा य गद्दतोया य । तुसिता अव्वाबाहा अग्गिच्चा चेव बोद्धव्वा ।।१।।

uppim sanankumāramāhindānam kappānam hētthim bambhalōgē kappē ritthavimānē patthadē ēttha namakkhādaga samacauramsasanthānasanthitātō attha kanharātītō pannatā tam jahā puracchimēnam dō kanharātītō dāhinēnam dō kanharāiō paccacchimēnam dō kanharāiō uttarēnam dō kanharāiō, puracchimā abbhantarā kanharāti dāhinam bāhiram kanharāim putthā dāhinā abbhantarā kanharāti paccacchimagam bāhiram kanharāim putthā, paccacchimagā abbhantarā kanharāti uttaram bāhiram kanharāim putthā, uttarā abbhantarā kanharāti puracchimam bāhiram kanharātīm putthā puracchima paccacchimillāō bāhirāō dō kanharātītō chalamsātō, uttaradāhināō bāhirāō dō kanharātītō tamsāō, savvāō'vi nam abbhantarakanharātītō cauramsāō 1 ētāsi nam atthanham kanharātīnam attha nāmadhējjā pannattā, tam jahā - kanharātīti vā, mēharātīti vā maghāti vā māghavatīti vā vātaphalihēti vā vātapalikkhōbhēti vā dēvapalihē vā, dēvapalikkhōbhēti vā 2 ētāsi nam atthanham kanharātinam atthasu uvāsantarēsu attha lōgantitavimānā

pannattā, tam jahā - accī, accimālī, vatiroanē, pabhankarē, candābhē, sūrābhē, supaitthābhē, aggiccābhē 3 ētēsu namatthasu lōgantitavimānēsu atthavidhā lōgantitā dēvā pannattā, tam jahā - sārasatamāiccā vanhī varunā ya gaddatōyā ya tusitā avvābāhā aggiccā cēva bōddhavvā 1 [23]

"Above the third and the fourth worlds of the gods namely Sanatkumāra and Māhēndra and below the fifth world of gods namely Brahmalōka, there are eight Krsnarājis in the shape of square dies i e Aksa (अक्ष) They are as follows

There are two Krsnarāji in each of four directions, east, south, west and north The inward Krṣnarāji in the east and the outward Krsnarāji in the south, touch each other The inward Krṣnarāji in the south touches the outward Krsnarāji in the west The inward Krsnarāji of the west touches the outer Krsnarāji of the north The outward Krsnarājis of the east and the west are hexagonal - six sided The outer Krsnarājis of the north and south are triangle-shaped The inward Krsnarājis of all sides are square-shaped Their names are Krsnarāji, Mēgharājī Maghā, Māghavatī, Vātapaligha, Vātapalighōksōbha, dēvaparigha, Dēvaparighōksōbha Between them there are heavenly abodes of the eight Lōkāntika gods namely Arci Arcimālī, Vairōcana, Prabhankara, Candraprabha, Sūryābha, Supratisthabha, Agnitōya (Śukrābha) The havenly abodes of Lōkāntika gods of the ninth kind namely, Rista, are the highest of all The names of Lōkāntika gods living in them are Sārasvata, Āditya,Vahni Aruna (Varuna) Gardatōya, Tusita, Avyābādha and Āgnēya (Marut) "

Krsnarāji contains and embodiment of darkness According to Jain scriptures, when a special kind of gods hide themselves, in the Krsnarāji, nobody can find them They almost disappear

Mr Nirajanbhai N Vakharia in his book "Cosmological Truths of Ancient Indian Religions, Jainism and Hinduism", shows positively that Krsnarāji itself is the blackhole Comparing them he writes

(1) As the black-hole curves the space according to Einstein's General Theory of Relativity (GTR), so Tamaskāya and krsnarāji attract and curve a large portion of space and ultimately, it gets transformed into a black-hole

(2) Nobody can enter Krsnarāji or the black-hole except through a special

kind of way, nor can anyone go across them Only a special kind of gods can enter Krsnarāji

(3) If a strange intruder enters Krsnarāji or the black-hole, he can never return and is destroyed there

(4) Scientists believe that at the other end of the black-hole, there is a counter universe named white hole Similarly at the other end of Krsnarāji, there is a counter-world of gods

(5) According to Mr Vakharia one of the two ends of Tamaskāya (embodiment of darkness) in the Arunavara ocean, is black-hole, the other is the white hole and krsnarāji is called worm hole [24]

The similarities shown above by Mr Vakharia are perhaps not proper The reasons are as under

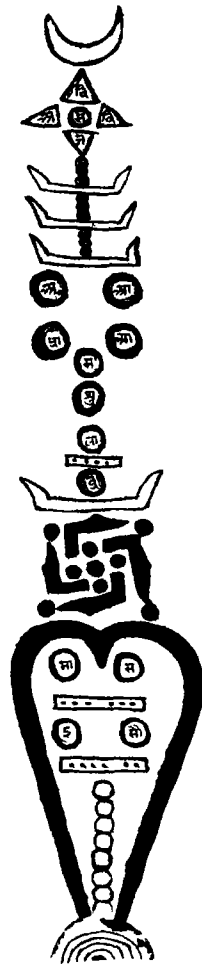
(1) Scientists show that space has a curved shape but according to the Jain theory, space is a one whole element/substance and it is inert or non-transformable in any condition Therefore, its shape cannot be changed

(2) Only a special kind of gods enter krsnarāji, when they wish They hide in it and can come out when they wish But attracted by its gravitational force, an object enters the black-hole without any effort and then it never comes out According to what scientists guess, it perhaps enters the counter universe of white hole This is only a conjecture and no reality This similarity is, therefore, not proper

(3) Scientists believe that if a strange intruder or intruding object enters the black-hole, it is destroyed None but gods can enter Krsnarāji There is, therefore no question of a strange intruder or intruding object entering it

The fourth and the fifth similarities shown by Mr Vakharia are mutually contradictory In the fourth similarity, he says that krsnarāji is the black-hole and its other end opens into the world of gods (counter-universe) named the fifth Brahmalōka But in the fifth similarity, the eight divisions of Krsnarāji are named worm holes There is, therefore, no propirety in both these similarities

According to science, there are many black-holes not only eight

He has also shown two more similarities which are not at all proper What is the reasons for believing that Krsnarāji or Tamaskāya is believed

Eight Black Strips known as astha Rajees belived to be in the Black Region of deep Darkness as shown the space by Jain Astronomy

Four might be four kingdoms of Gods in space and other four oblong rectangular shape strips can be perhaps the bridges to reach these kingdoms can possibly be working as Einstein-Rosen Bridges as per thinking of Mr Niranjan Vakharia

black-hole? Pondering over it, we reach the following conclusion

'Krsnarāji' includes the word 'Krsna' 'Krsna' means black and Tamaskāya means a black dark object On account of this verbal similarity modern Jain scholars are naturally prompted to believe that Krsnarāji and Tamaskāya are black-holes

On account of such verbal similarity, there prevails among Jain scholars, a misunderstanding about Einstein's Theory of Relativity Whenever Einstein's Theory of Relativity is under discussion, Jain scholars proudly say that the Theory of Relativity given by Einstein was shown by Bhagavān Mahāvīra 2500 years ago Thus they compare Einstein's Theory of Relativity with Anekāntvāda or Syādvāda of Jainism Really speaking, they are quite different from each other and there is no relation between them Anekāntvāda of Bhagavān Mahāvīra teaches us to think of elements, objects etc from various view points It, therefore, pertains to thoughts But Einstein's theory of relativity explains only visible physical phenomena and it is based on postulates Those postulates are not true according to the philosophical *concepts of Jainism*

Likewise, there is nothing more than verbal similarity between krsnarāji or Tamaskāya and black-holes, we cannot therefore, rule out the possibility that the real fact may be of quite a different nature

The first thing is that Krsnarāji described by Jain scripturists is certainly not in the world of human beings Krsnarāji is shown to be located below the fifth world of gods namely Brahmalōka From the world of human beings it is at a distance of more than at least three Rājalōkas According to Jain scripturists one Rājalōka is equal to innumerable Yōjanas According to the last gross calculation shown by Muni Śrī Mahendrakumar 'Dvitiya',

$$Rajju = 4 \times 10^{\{1\,8 \times 10^{245} + 3\}} miles$$ [28]

It cannot be believed that the signals coming from krsnarāji which at a greater distance than three Rājalōkas, can be received by radio telescopes of our scientists because in the two intermediate Rājalōkas there are four worlds of gods Moreover, there are in the madhya Lōka suns, moons, planets, constellations, stars and such other space objects which are crores multiplied by crores in number It does not seem possible that maintaining their

identity as separate from all these space objects and signals coming from them, these signals can reach to the world of human beings

Moreover, the structures of Krsnarāji and black-holes are altogether different

(1) Gods hide in Krsnarāji and they can also come out The object that goes into the black-hole, never returns It is absorbed inside the black-hole

(2) It never happens that gods are unwillingly pulled into krsnarāji on account of its gravitational force but the gravitational force of the black-hole is so stupendous that it pulls any physical object that comes into its field and there is no exception Even light with a velocity of 3,00,000 km/sec cannot escape from its gravitational force The result is that we do not know what the black-hole is really

(3) Light that falls on the black-hole, is not reflected and, therefore it looks like a really black object

(4) In Jain scriptures, there is no mention of density or gravitational force of the black object in Krsnarāji With a special type of mathematics scientists have through researches, determined the stupendous gravitational force of the black-hole and its density Since these imaginary objects are at a distance of thousands of light years we cannot know their density or gravitational force by perceptible or direct experiments but we can know that only through mathematics

In short, Krsnarāji or Tamaskāya described in Jain scriptures and the black-hole guessed by scientists, seem to be altogether different objects

As shown above, in modern astronomy there is no relation whatsoever between the blackhole searched out by scientist and Krsnarāji or Tamaskāya described in Jain scriptures The question, therefore arises how to explain the black-hole on the basis of the physics described in Jain scriptures Using Einstein's Special Theory of Relativity, Einstein's Theory of gravitational force i e General Theory of Relativity and physics described in Jain scriptures we can explain the black-hole as under

According to Jain scriptures, there are six basic/fundamental elements in the whole universe - 1 Dharma(the medium for motion) 2 Adharma (the medium for rest) 3 Ākāśa (space) 4 Pudgala (matter) 5 Jīva (Soul) 6 Kāla

(time) [26]

The dharma element helps the motion of an object It is one and whole and pervades the whole universe Similarly, the adharma element is also one and whole and pervades the whole universe But it helps to keep an object at rest [27] Since both these elements are non-material, they are incomprehensible Ākāśa (space) is also one and whole element But space in the universe (Lōka) is called Lōkākāśa while space outside the universe is called Alōkākāśa

Dharma, adharma and Ākāśa (space) - these three are devoid of Kriyā (activity i e motion) This means that they do not undergo a transformation of the form of modification [28] Kāla (time) is also regarded as an element [29] The Jain physics accepts all the characteristics of the pudgal (matter) which the modern physics accepts Regarding the matter, the concepts of the modern physics and concepts of the Jain physics are altogether similar Sometimes even the definitions are also similar Only the interpretations and illustrations of the definitions are found to be different e g the definition of paramānu (atom) [30]

According to Jain scriptures, even light is nothing but a transformation or modification of the matter [31] Therefore, as the laws of gravitational force apply to other physical objects so they apply to light also i e Light is also influenced by gravitational force But the modern physics believes that light is in the wave-form and, therefore, it is a non-material That is the reason why in order to explain the deviation of star-light, it has to believe that the space (Ākāśa) is curved/contracted by an object of stupendous mass that the sun is But omniscient Tīrthankaras (Srī Mahāvīrasvāmi and others) who lived 2500 years ago have shown that space is a non-material and devoid of activity and that light is a matter

All visible objects in the universe and all subtle objects which are their basic units are material or combinations of matter and Jīva i e soul The fifth chapter of the 'Tattvārthasūtra' authored by Umāsvātijī, gives a detailed discussion of five out of the six elements apart from the soul In the terminology of modern science, it can be said this chapter contains the basic principles of physics and chemistry

According to Einstein's Special Theory Of Relativity, as the velocity of an

object rises, three types of changes are occurred in it

1 We can know from the following equation that as the velocity of an object increases, its mass-increases $m_v = \frac{m_0}{\sqrt{1 - v^2 / c^2}}$, where m_v is the mass of an object in motion, m_0 denotes the mass of the object, when it was at rest, and v and c respectively denote the velocity of the object and the velocity of light [32]

2 As the velocity of an object rises, its length decreases and this can be known from the following equation $L_v = L_0 \sqrt{1 - v^2 / c^2}$, where L_v is the length of the object in the motion, L_0 denotes the length of the object, when it was at rest and v and c denote the velocity of the object and the velocity of light respectively [33]

3 As the velocity of an object rises, time for it becomes slower and slower and this can be known from the following equation $T_v = T_0 \sqrt{1 - v^2 / c^2}$, where T_v denotes the time-duration, while the object was in motion T_0 denotes the time-duration, when it was at rest, v and c respectively denote the velocity of the object and the velocity of light [34]

According to the equations given above, if the velocity of an object equals the velocity of light, the mass of the object would rise to infinity, the volume or length of the object would be reduced to zero and for that object time stops

Space objects are always in motion Of course, the velocity of all objects is not equal nor is the mass of all objects equal But according to Einstein's equations shown above, as the velocity of space objects rises, the mass of space objects in motion, increases and the length or volume decreases But on the other hand, according to his General Theory of Relativity i e the law of gravitational force, as the mass of an object rises, its gravitational force increases Besides, as the volume of an object is reduced, its gravitational force increases According to the equations shown above, here the mass of space objects in motion increases and volume-length decreases Thus in both the ways, the gravitational force of the objects increases tremendously

Of course, the rise in mass and the reduction in volume-length caused by the velocity of the objects, are only virtual and not real and consequent rise in gravitational force is also only virtual

If the velocity of the space objects rises to be equal to or greater than the

velocity of light, according to Einstein's Special Theory of Relativity, the virtual mass of the objects would rise to infinity and their length/volume would be reduced to be zero or mathematically less than zero In these circumstances even the virtual gravitational force rises to be infinite They are transformed into black-holes and become invisible

As a matter of fact, if the velocity of an object, rises to be equal to or greater than the velocity of light, the object becomes invisible Light that falls on it, is reflected but till it reaches us it becomes excessively dim, its intensity excessively reduced or in technical terms of modern science, since the wave-length rises tremendously i e the amplitude is reduced tremendously and becomes less than infrared rays, the object becomes imperceptible to our eyes and that is the reason why, if we observe in the direction through telescope etc , we see only black spots or darkness in the round shape

There are several reasons why the rise in mass and reduction in length/ volume are considered to be virtual 1 There is an eternal rule of science and of Jain philosophical treatises that the quantity of matter (pudgal) and its mass in the whole universe is fixed and always constant 2 The second reason is as under

In the fifth Angasūtra, the Jain canonical scripture entitled Śrī Bhagavatīsūtra or Śrī Vyākhyāprajñapti or Śrī Vivāhapannatti, the twenty fourth Jain Tīrthankara Śrī Mahāvīrasvāmi said to his first disciple Ganadhara Indrabhūti Gautam, nearly 2550 years ago

परमाणुपोग्गले णं भते ! लोगस्स पुरत्थिमिल्लाओ चरिमताओ पच्चत्थिमिल्ल चरिमत एगसमएण गच्छति, पच्चत्थिमिल्लाओ चरिमताओ पुरत्थिमिल्लं चरिमंत एगसमएण गच्छति, दाहिणिल्लाओ चरिमंताओ उत्तरिल्ल० जाव गच्छति, उत्तरिल्लाओ दाहिणिल्ल० जाव गच्छति, उवरिल्लाओ चरिमताओ हेट्ठिल्लं चरिमत एग० जाव गच्छति हेट्ठिल्लाओ चरिमताओ उवरिल्ल चरिमत एगसमएण गच्छति ? हता गोतमा ! परमाणुपोग्गले ण लोगस्स पुरत्थिमिल्लाओ चरिमताओ पच्चत्थिमिल्लं० त चेव जाव उवरिरल्लं चरिमंतं गच्छति ।

(भगवतीसूत्र, शतक-१६ उद्देशक-८)

paramānupōggalē nam bhantē ! lōgassa puratthimillāō carimantāō paccatthimillam carimantam ēgasamaēnam gacchati, paccatthimillāō carimantāō puratthimillam carimantam ēgasamaēnam gacchati, dāhinillāō carimantāō uttarillamO jāva gacchati uttarillāō dāhinillamO jāva gacchati uvarillāō carimantāō hētthillam carimantam ēgaO jāva gacchati, hētthillāō

carimantāō uvarillam carimantam ēgasamaēnam gacchati ? hantā gōtamā ! paramāṇupōggalē nam lōgassa puratthimillāō carimantāō paccatthimillamO tam cēva jāva uvarirallam carimantam gacchati

(Bhagavatīsūtra, Śataka-16 Uddēśaka-8)

(Question) (Indrabhūti Gautam) O, Bhagavān! Does a pudgala i e atom go in one samaya from the extreme end of east of the universe to the extreme end of the west of the universe? and from the extreme end of the west to the extreme end of the east?, from the extreme end of the south to the extreme end of the north?, from the extreme end of the north to extreme end of the south?, from the upper extreme end to the lower extreme end and from the lower extreme end to the upper extreme end of the universe?

Ans (*Śrī Mahāvīrasvāmi*) O *Gautam'* Yes, In one *Samaya* a ***pudgala*** atom goes from the extreme end of the east of the ***Lōka*** (universe) to the extreme end of the west of the universe and so on

(Bhagavatī sūtra, śataka-16, Uddēśaka-8) [36]

This means that a physical object can travel in one *Samaya* , i e 10^{500} second[36] from the upper extreme end of the universe to its lower extreme end or from the lower extreme end of the universe to its upper extreme end i e a distance of 14 Rajju (***Rājalōka***) i e $14(4 \times 10^{\{18 \times 10^{245}+3\}})$ miles [37] According to the postulate of Einstein's Special Theory of Relativity, the velocity of a physical object is never greater than that of light Of course, the mathematics based on this postulate seems to be comparatively true in respect of visible objects or events But as shown above, when the velocity of an object surpasses the velocity of light not a single equation of Einstein's Special Theory of Relativity is useful On the contrary, these equations say that the objects with a greater velocity than that of light are only imaginary But the greatest omniscient, who has perfect knowledge of all the three phases of time of all objects in the whole universe, goes to the length of saying that a physical object at rest, goes on increasing its velocity through an external force and acquired the highest velocity shown above and an object with the highest velocity goes on decreasing its velocity and can become motionless

In these circumstances, the mass and length of an object in motion which we get through Einstein's equations are only apparent When the object again

becomes motionless or come to rest, it regains its original mass and length How can then a *reduction* in mass and rise in length be possible?

3 When the velocity of an object rises to be equal to velocity of light, the volume/length of the object becomes zero This means that it loses its existence How can then its mass become infinite? Only those objects which have existence, can have mass Mass is a property and it belongs only to an object When an object has no existence, what can have infinite mass?

4 If we say that an object is destroyed and transformed into energy, that is also not proper Energy is also a property and in various objects, it expresses itself in various ways The energy of different objects is not of the same form In this connection Harry L Shipman says in the introduction to his book - 'Black Holes Quasars and The Universe'

"Light is a form of energy It is difficult to define precisely the term 'energy' much in the news recently It is easier to develop a mental picture of the energy concept by asking what energy does The usual definition of energy' is 'the ability to do work' which is an accurate description The type of work that energy does varies with its form Light energy can illuminate the printed page, heat energy can keep us warm, kinetic energy (or energy of motion) can be used to move something from one place to another "[38]

Regarding energy, scientist themselves say "Whatever happens in the universe, *can neither create nor destroy energy* "[39] i e Whatever happens in the world, energy is not destroyed nor can new energy be created

Since energy is a property, it must belong to the substance Only a Jīva (soul) or a pudgal (matter) is its abode In the Tattvārtha Sūtra, the Jain scripture, Srī Umāsvātijī says about properties 'द्रव्याश्रया निर्गुणा गुणाः । *dravyāśrayā nirguṇā guṇāh* '[40] Properties belong to substance and they have no properties This means that energy therefore, belongs to matter and a few other reals In short science shows that energy is constant and indirectly shows that the quantity of a pudgala i e matter is also constant

5 The physics theoretically shows that an object can be transformed into energy and energy can be transformed into an object [41] But by experiments, energy can be obtained from an object (of course not wholly) but the object cannot be regained from energy This means that the proposition that an object can be regained from energy, is only imaginary Though it is true

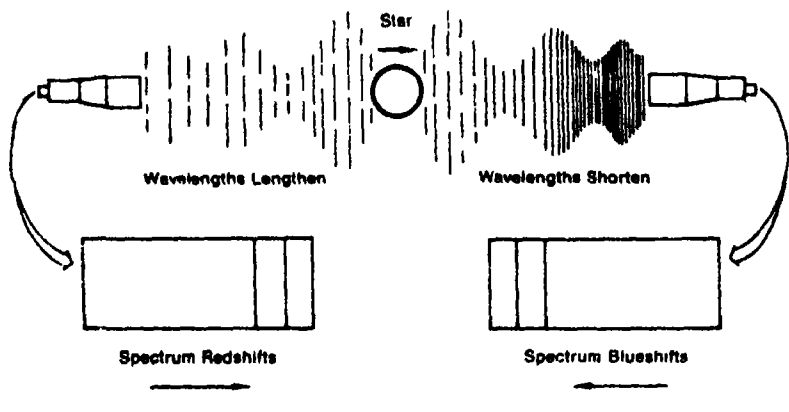
mathematically or theoretically, it never seems possible in practice That is why an object in motion, regains its original length/volume when it becomes motionless, proves that the length of an object in motion, is only apparent

6 Of what kind the energy is that causes rise in the mass of an object in motion? This is also certainly a puzzle As a matter of fact, while an object is in motion, energy is obtained from it Its mass should, therefore, be reduced but theoretically mass increases

7 According to what scientists say, the gravitational force of black-holes is so tremendous that even light cannot escape from its gravitational force This means that the escape velocity of black holes is above 3,00,000 km/sec If this is true, no radiation of any kind, not even infrared radiation nor even ultraviolet radiation can escape from its gravitational force because like light, all these kinds of radiations are only a special kind of electromagnetic waves and their velocity is only 3,00,000 km/second Einstein himself says, "No signals are faster than light "[42] Experimental facts show that black-holes do not gulp everything On the contrary, a special kind of radio waves come out of them and they are detected by radio telescopes It is by means of them that black-holes are discovered By analysing them, the origination, inner structure or construction, distance and the velocity of black-holes are determined

In short the knowledge of tremendous gravitational force of black-holes is only virtual, not real It is an imaginary presumption based on imaginary mathematics

I conclude that according to the principles described in Jain philosophy, the black-holes are nothing but only space objects with a greater velocity than that of light Since they move in the direction opposite to that of the earth, they appear to be only black spots in that direction If they moved towards the earth, they could possibly be seen as white dwarfs or Neutron stars It is precisely this that can be explained through its spectrum

Black-holes are among the objects which have a greater velocity than that of light As the velocity of the object is greater, the visible form of black-holes is small and as the velocity is less and nearer to the velocity of light, the visible form of black-holes is bigger This is my personal belief and assumption The velocity of visible and invisible space objects can be known by receiving radiations or light coming from them, by getting photographs of their spectrum and by analysing them

Astronomers see Doppler shifts in stellar spectra as the colors (or wavelengths) of the dark lines change depending on the motion of the star

If the space object goes away from the earth, from us, the vertical dark lines on the spectrum seem to have shifted to the right side This is called red shift If the object comes nearer to the earth, the vertical dark lines on the spectrum seem to have shifted to the left side This is called blue shift Both these shifts are known in physics as the Doppler effect or the Doppler shift [43]

Such various spectra are available for black-holes, white holes or white dwarfs and neutron stars also Through their study, scientists determine the velocity of these objects Among the signals coming from distant space objects, especially from black-holes and received through radio-telescopes, two signals coming from the same object, have some duration of time between them The greater the velocity of objects which have a greater velocity than that of light, the longer the time duration between two signals and the lesser the velocity, the lesser the duration of time between two signals The time duration between two signals received from some objects which have been transformed into black-holes varies from 0 3 second to 1 5 seconds [44] According to my calculations, these black-holes go away from the earth at a velocity which is greater than that of light The velocity of a black-hole which has a time duration of 0 3 second, can be 3,90,000 km/sec whereas the velocity of a black-hole which has a time duration of 1 5 seconds can be

7,50,000 kms/second With the change of velocity, there can be more or fewer red shifts in the spectrum received from the object

Here I have theoretically represented only my views in a descriptive form only in accordance with the doctrines of Jain philosophy I conclude this article with the hope that Jain scholars of physics will help me in future to do more research work mathematically, precisely in this subject

Date 16 11 96,

Bhavnagar

References

1 Each new advance poses still more questions, sometimes making the universe more puzzling, not less

['Black Holes, Quasars And The Universe' by Harry L Shipman, Houghton Mifflin Company, Bostan, U S A , p 14]

2 If we cannot see a black-hole, how do we tell what it looks like? The pencil and paper calculations of the theoretical physicists help us here [Ibidem, p 14]

3 The radius is numerically equal to 2 95 kilometres times of the mass of the hole in solar masses Our ten-solar-mass hole is thus 30 kilometres in radius or 60 kilometres across [Ibidem p 71]

4 On Phobos the force of gravity is so small that men's arm would be strong enough to put a small stone into orbit around it, or even send it into orbit about Mars itself, some 9000 kilometres away

The escape velosity is only 5 m/s for Phobos [Black Holes, by Jean-Pierre Luminet, Cambridge University Press, U K p 6, 7]

5 To put a satellite into orbit, the rocket launcher has to reach a certain altitude incline itself to be parallel to the Earth's surface and then increase its velocity to at least 8 km/s At this velocity the centrifugal force (directed into space) balances the gravitational force (directed towards the centre of the Earth)
[Ibidem,p 6]

6 This critical velocity - identical for a pebble or a rocket - is called the escape velocity On the Earth's surface it is 11 2 km/s, and it can easily be calculated for any planet, star or other celestial body [Ibidem, p 7]

7 The escape velocity is only 5 m/s for Phobos and 2 4 km/s for the moon, but 620 km/s for the Sun From a more dense star, such as a white dwarf, it reaches several thousands kilometres per second [Ibidem, p 7]

8 The greater the mass, the greater the escape velocity, and for a given mass

the escape velocity will increase as the radius of the star decreases

[Ibidem, p 7]

9 The notion of a black-hole ultimately derives from the simple concept of escape velocity The velocity of light has been known to be about 3,00,000 km/s since Olaus Roemer's observations of Jupiter's moon in 1676 It is easy to imagine the existence of stars so massive that the escape velocity from their surface is greater than the velocity of light [Ibidem, p 7]

10 In an article read to Royal Society in 1783 and published later in Philosophical Transections, John Michell wrote "If the semidiameter of a sphere of the same density with the Sun were to exceed that of the sun in proportion of 500 to 1, a body falling from an infinite height towards it would have acquired at its surface a greater velocity than light and consequently, supposing light to be attracted by the same force in proportion to its vis inertiae with other bodies all light emitted from such a body would be made to return towards it by its own proper gravity " A little later, in 1796, the mathematician and astronomer Pierre Simon, Marquis de Laplace the prince of celestial mechanics made similar remarks in his Exposition du systeme du monde [Ibidem, p 7]

11 In 1911, while he was working at the University of Prague, Einstein calculated for the first time the deviation of light in a gravitational field His results were to have been verified during the 1914 eclipse, but war was declared and the project abandoned This was fortunate for Einstein, as his theory was not quite mature and his prediction would have been in error [Ibidem, p 56]

12 Einstein perfected his General Relativity equations in November 1915 and published the results in the Berliner Berichte in the numbers dated 4 11 18 and 25 November [Ibidem p 56]

13 The deviation of light ray passing close to the Sun was measured during the solar eclipse on 29 May, 1919 at Sobral (Brazil) [Ibidem, p 56]

14 In December, 1915 a month after Einstein published his equations of General Relativity, the German physicist Karl Schwarzschild discovered the solution which described the gravitational field surrounding a sphere in a vacuum [Ibidem p 119]

15 In a famous article in 1931, he (Indian astro-physicist Subramanyam Chandrashekhar) proved that white dwarfs had a maximum allowed mass, and calculated this to be 1 4 $M_{\odot}$ [Ibidem p 75]

16 White dwarf compact much of the mass of the star into a volume of the size of the Earth, while neutron stars are smaller still only 20 kilometres across

[Black Holes, Quasars and The Univrse by Harry L Shipman, p 25]

17 Some investigators believe that the maximum mass of neutron stars is quite small about 0 7 M_O Others with different ideas of how neutrons interact, believe that the limiting mass is higher about 2 2 M_O

The crucial question now becomes Are there any stars that leave remnant with more mass than the magic figure of three solar masses? (The maximum mass of a neutron star is probably less than this, but I stick with the figure three because it is certain that no evolved star can have more mass than that and remain stable) [Ibidem, p 60]

18 A black-hole is not shown because the star would have to be over 3M_O initially before it could become a black-hole Its final size would be similar to that of neutron star ['Black Holes', by J P Luminet, p 103]

19 During the night of 23-24 February 1987, the Canadian astronomer, Ian Shelton working at the Las Companas Observatory in Chile had the extraordinary good fortune to be the first 'professional' to discover a supernova (a night assistant had just noticed it with the naked eye as a 4th magnitude star) The Large Magellanic Cloud, in which the supernova occurred, is an irregular galaxy A telegram was sent urgently to the Bureau of the International Astronomical Union and caused an immediate sensation in the astronomical community

[Ibidem p 94]

20 The density varies from 1 tonne/cm^3 to 4 00,000 tonnes/cm^3

[Ibidem, p 110]

21 A 10 M_O spherical black-hole has an area of 5650 square kilometres comparable to the size of a country Similarly the surface gravity is inversely proportional to the mass A 10M_O spherical black-hole has a surface gravity 150 billion times that of the Earth [Ibidem, p 196]

22 A typical mini black-hole of 10^{15} grams, the size of a proton, has a temperature of trillion K [Ibidem p 210]

23 Sthāngasūtravrtti P 432 433 (Sūtra-623)

24 Cosmological Tuths Of Ancient Indian Religions, Jainism And Hinduism by Niranjan Vakharia, Chapter XXVI, p 234, 235

25 'Jainism Through Science' (English version) by Muni Nandighoshvijay, p 13

26 अजीवकाया धर्माधर्माकाशपुद्गला ।।१।। द्रव्याणि जीवाश्च ।।२।। कालश्चेत्येके ।।३९।। *ajīvakāyā dharmādharmākāśapudgalāh 1 dravyāni jīvāśca 2 kālaścētyēkē 39* (Tattvārtha Sūtra, Chapter V)

27 आऽऽकाशादेकद्रव्याणि ।।५।। गतिस्थित्युपग्रहो धर्माधर्मयोरुपकार ।।१७।। *ā''kāśādēkadravyāni 5 gatisthityupagrahō dharmādharmayōrupakārah 17* (Ibidem, Chapter V)

28 निष्क्रियाणि च ।।६।। *niskriyāni ca 6* (Ibidem, Chapter V)

29 कालश्चेत्येके ।।३९।। *kālaścētyēkē 39* (Ibidem, Chapter V)

30 परमाणुरप्रदेश ।। *paramānurapradēśah* (Lectures on Nandi Sūtra in Gujarati by H H Ācārya Śrivijaya Nandanasūriji Mahārāja)

31 शब्द-बन्ध-सौक्ष्म्य-स्थौल्य-सस्थान-भेद-तमश्छायाऽऽतपोद्योतवन्तश्च ।।२४।। *śabda-bandha sauksmya-sthaulya samsthāna-bhēda-tamaśchāyā''tapōdyōtavantaśca 24* (Tattvārtha Sūtra, Chapter V)

32, 33, 34 Jainism Through Science (English version) by Muni Nandighoshvijay (p 4,5)

35 [Ibidem p 8] 36 [Ibidem p 12] 37 [Ibidem p 13]

38 39 'Black Holes Quasars And The Universe' by Harry L Shipman p 4)

40 Tattvārtha Sūtra (Chapter V, sūtra No 40)

41 $E=mc^2$ Special Theory of Relativity, Mass-Energy Equivalance

42 Introduction To Special Relativity by Robert Resnik Willey Eastern Limited 1988

43 'Black Holes Quasars And The Universe' Harry L Shipman (See Fig 5-3 5 4)

44 *Brahmāndanun Cālaka Gurutvākarsanabala* by Paresh Vaidya, Navneet-Samarpana (Nove , 1996 p 213)

8. Jainistic And Scientific Analysis Of Extrasensory Perceptions Of Śrī Ashok Kumar Dutt

Śrī Ashok Kumar Dutt, who is a mechanical engineer in Bharat Heavy Electricals Limited, Noida, (Ghaziabad), can see the human aura Not only that but he also can know the kinds of thoughts of men on the basis of its colours With extrasensory perception he is able to see the colours of sound

When someone spoke, Śrī Ashok Kumar saw a mass of variously glittering colourful particles Besides, he saw various kinds of coloured particles emerging from living and nonliving objects Also, he sometimes saw living objects absorbing coloured energy particles from the surrounding atmosphere In his article 'The Secrets of the Alphabet and the Incantation-sound' in the October-December, 1992 issue of 'The Farbus Quarterly', he has narrated some of his experiences about sound I was very much delighted to read that article His experiences are much in keeping with the Jain view of reality We shall analyse them later on Let us first get acquainted with the belief of modern scientists regarding sound

Generally, scientists believe that both sound and light are in the form of waves Of course, some phenomena of light and especially the phenomenon of photo-electric-effect, can be explained only by accepting light in the form of particles Scientists call these particles photons They were first called 'quanta' by Einstein and the science that deals with them, is called quantum mechanics

Light[1] is of two types 1 Visible light and 2 Invisible light Invisible light, i e the electromagnetic waves are also of two types (1) that which has less/low frequency and greater wave-length than visible light which is known as infrared waves and (2) that which has greater/high frequency and small wave-length than visible light and which is known as ultraviolet rays [2]

The classification of sound is similar to that of light Generally, the human ear can hear sounds with a frequency varying from 20 to 20,000 Sound is of

two types 1 audible sound with a frequency varying from 20 to 20,000 and 2 inaudible sound which is also of two types (1) Sound with a less/low frequency than 20, is known as infrasonic waves The elephant can hear infrasonic sound (2) Sound with a greater/higher frequency than 20,000 is called ultrasonic sound With the help of sound waves of this type, the urine stone can be reduced to powder and removed without a surgical operation In short, the scientists of today believe that sound is entirely in the form of waves They believe that electromagnetic waves behave like waves in certain circumstances and in other circumstances they behave like particles Thus modern science and scientists accept the dual nature of light

On the other hand, the extrasensory perceptions of Śrī Ashok Kumar Dutt prove that light, the electromagnetic field which is called aura of objects, mind, thoughts and sound – all these are in the form of matter i e pudgal – the most micro atoms/particles and this fully supports the Jain philosophical view

According to Jain philosophy, there are only six kinds of fundamental substances in the whole universe They are 1 soul, 2 matter, 3 space, 4 time, 5 the medium for motion (dharma) and 6 the medium for rest (adharma) Some Jain philosophers regard time as a substance and some do not [3] Of all these substances, five substances except matter are formless Only the matter (pudgal) has form [4] In combination with element matter, the element soul seems to have a form Jain philosophers mention that the matter has the characteristics namely colour, smell, taste and touch [5] The subtlest part or atom of an element matter, which by any instrument, could never be divided in the past, can never be divided in the present and is never going to be possible to be divided in the future, is called an atom Though in modern physics, the subtlest indivisible part of a substance is called an atom, it is now divided into sub-atomic particles namely electrons, protons, neutrons, quarks etc It is, therefore, not proper to call it a paramānu (atom)

An atom (paramānu) has a colour, a smell, a taste and two touches [6] It means that it has a form But it is so subtle that it cannot be seen with the naked eyes, nor can it be seen with any instrument such as an ultramodern electorn-microscope It can be seen with the eyes or an instrument only after infinite atoms have gathered up in a mass

Grouping of infinite atoms have been classified by Jain philosophers into

eight types Their names and uses are as under

1 The Audārika types of grouping i e Varganā

Every unit of this type of Varganā (grouping)[7] has infinite atoms Bodies of all living beings in the whole visible universe are made of it, except the bodies of hell beings and divine beings According to Jainism earth, water, fire and wind are also living being and, their bodies are also made up of this type of Varganā

2 The Vaikriya Varganā

Every unit of this type of Varganā has also infinite atoms (paramānus) But unit of this type of Varganā has many more numbers of atoms than the number of atoms in the former type of Varganā Similarly every unit of later type of Varganā has an increasingly larger number of paramānus (atoms), which are more and more subtle in form Bodies of gods and goddesses i e divine beings and hellish beings are made of this type of paramānu-units (Varganā) Even human beings sometimes make another body of this type of paramānu-units (Varganā)

3 The Āhāraka Varganā

Jain monks who have attained a specific level of deep learning, use the paramānu-units of this type of grouping (Varganā) to make a crystaline body of the size of a close-fisted hand

4 The Taijas Varganā

With the paramānu-units of this Varganā (grouping), a subtle called taijas (vital) body is formed by every living being Food is digested with its help

5 The Bhāsā Varganā

All living beings varying from those with two senses to those with five senses, celestial, human and hellish beings absorb the paramānu-units of this Varganā, and transform them into distinct or indistinct sound and release them in the atmosphere

6 The Śvāsōcchvāsa Varganā

Every living being inhales and exhales with the paramānu-units of this Varganā

7 The Manō Varganā

The minds of all gross five-sensed living beings (celestial, human, hellish and animals) are made of this type of paramānu-units (Varganā) Moreover they are used in various processes of thinking

8 The Kārmana Varganā

The paramānu-units of this type of Varganā get transformed as auspicious or inauspicious karma and stick to the soul They make a special type of subtle body named the Kārmana body

In both of his articles, Śrī Ashok Kumar Dutt shows that the groups of coloured energy particles are chiefly of the three colours - red, yellow and blue But in the description of the element pudgala i e matter, Jain philosophers show that they have five colours - white, red, yellow, blue and black As far as drawing is concerned, there are only three colours, red, yellow and blue [8] The rest of the colours are made by mixing these colours In the printing of coloured pictures, red, yellow, blue and black colours are used

There are two types of smell 1 good smell and 2 bad smell

There are five types of taste 1 bitter, 2 pungent, 3 astringent, 4 sour 5 sweet The saltish taste is not taken into account here but it is accepted as sixth taste in other Jain works [9]

There are eight types of touch 1 heavy 2 light, 3 soft, 4 hard, 5 cold, 6 hot, 7 smooth, Snigdha स्निग्ध 8 rough Ruksa रूक्ष [10]

A single solitary atom has two types of touch 1 cold or hot and 2 smooth or rough (Snigdha स्निग्ध or Ruksa रूक्ष) Some paramānu-units made of infinite atoms have sometimes four touches Some have all the eight touches The first four of the eight types of Varganās shown above have all the eight types of touch The last four Varganās of the eight types of Varganās shown above, have four types of touch

Having got this background information of the pudgala (matter) we, shall now analyse the experiences or extrasensory perceptions of Śrī Dutt

Chiefly blue particles seem to emerge from the sound of a conch-shell It is customary to make sound of a conch- shell at the time of evening prayer in Hindu temples It is said that the sound of a conch- shell removes turbidity/

impurity and inauspiciousness of atmosphere and this is proved by Śrī Dutt's experience mentioned above Similarly, blue particles emerge from the sound of temple bell which is of the shape of a pyramid At the one-third of the height of pyramids, domed temples and buildings of the shape of a pyramid, under the apex, objects store blue energy-particles They have probably the highest energy and that is why fruits, flowei kept in the pyramid at one-third of its height just under its apex remain fresh for a long time and then they dehydrate but do not decay A lot of research work has been done on this in the west and a number of books have been written on this subject [11] Śrī Dutt's extrasensory perception of pyramid substantiates this statement

Defining the word pudgala (पुद्गल) (i e matter), Jain philosophers say that a pudgala is something in which the processes of fusion and fission are constantly going on [12] पूरयन्ति गलयन्ति इति पुद्गला (*pūrayanti galayanti iti pudgalāh*) Śrī Dutt's extrasensory perceptions show that red, yellow and blue particles constantly emerge from all living and non-living objects in the whole universe It means that with a special aptitude or power of his eyes he has seen the process of fission taking place in non-living paudgalic (material) objects, the process of disintegration of atoms of an object He saw the process of fission with his eyes because it is greater than the process of fusion in the non-living objects But when the same objects are placed in a pyramid, a refrigerator or a special type of atmosphere, the process of fission becomes slower and the process of fusion which absorbs blue energy particles, becomes faster The processes of fusion and fission are constantly going on in the human body too [13] and it is clearly experienced by Śrī Ashok Kumar Dutt This perfectly substantiates the doctrines laid down by Jain philosophers

According to Śrī Dutt, the red particles are the least energetic Modern science also accepts this When a sun ray passes through a prism, it is divided into seven colours and in the colour spectrum, that is formed, the red rays - particles have least frequency and the violet rays/particles have the highest frequency And according to the law of physics, the higher the frequency of rays/particles, the higher the energy of rays/particles Rays with a low frequency than the frequency of red light i e electromagnetic waves having low frequency cannot be grasped by our eyes They are called infrared rays Similarly, rays with a higher frequency than the frequency of violet rays or electromagnetic waves are called ultraviolet rays and they can also be not

grasped by our eyes

Śrī Dutt says that between non-living things and living, there is a intermediate state of things The non-living body after the death, flowers and leaves fallen from trees and plants belong to this state They first emit blue, then yellow and then red particles and then they decay

Regarding food of monks and nuns of the svetambar idolatrous sect, there is a rule that they can accept ripe fruits etc after 48 minutes after they have been cut and juice has been extracted from them Śrī Dutt's experiences described above reveal the secret of this rule Generally, we believe that ripe fruits become lifeless soon after they have been cut But as long as all the blue particles have not been emitted, they are probably alive and during emission of yellow particles, they are lifeless but they do not contain bacteria But bacteria have already entered them when red particles are emitted That is why fruits are fit to be accepted by monks and nuns only when they are in the intermediate state between the two states

Moreover, in cold places also, blue particles are more quantitative The refrigerator is the best illustration of this That is why fruits etc in a refrigerator or in such places, remain fresh for a long time They can remain alive there In heat all fruit etc decay and are soiled soon because in heat they quickly emit energy-particles There are records of instances which show that dead bodies of human beings and animals buried under snow have remained fresh for thousands of years That also substantiates this fact

Śrī Dutt says from his experience that in nature, i e in places of natural beauty such as green vegetation, ponds, wells, river-banks etc , there are abundant blue particles near the bottom of the earth Trees, plants etc emit blue particles in the morning hours They emit yellow and blue particles during the day time, and at night they emit red particles and absorb blue particles They grasp red particles in the morning Students of science, generally, know that during the day time, plants, trees etc absorb carbon-dioxide and emit oxygen At night plants, trees etc absorb oxygen and emit carbon-dioxide This shows that oxygen has blue molecules and carbon-dioxide has red molecules And it is a scientifically proved fact that oxygen has energy for vital functions and that is why whoever controls breath or takes deep breaths i e Prāṇāyāma enjoys good health

Of course, this is an inference based on the extrasensory perceptions of Śrī Dutt and it is in keeping with the contention of Jain philosophy and it is probably nearest to truth All cannot have such experiences because this is a gift of nature We should not, therefore, underestimate it

Śrī Dutt proposes to study the body from two view- points 1 the subtle body and 2 the Kārana body This will make it easy to understand the facts of colours

According to the Jain scriptures, the body is of five types 1 The Audārika body, 2 The Vaikriya body, 3 The Āhāraka body, 4 The Taijas body and 5 The Kārmana body All these five types of body have been mentioned earlier in the description of the forms of Varganās i e groupings of paramānu-units Since they have a special relevance here, they are mentioned here again Every living being has at least three bodies In certain circumstances, some highly developed men have four bodies but never has a living being five bodies at the same time Generally, the living beings of physical world, namely, earth water, fire wind plants etc who have only one sense of touch and very small insects i e micro organisms and other creatures which are classified by the Jain biology into the two-sensed, three-sensed and four-sensed living beings, aquatic living beings such as fishes etc beasts such as the cow, the horse, the elephant etc , the snake, the squirrel etc and birds such as the sparrow the crow, the parrot, etc which are called five-sensed have only three bodies each The Audārika body, the taijas body and the Kārmana body To their vaikriya body they can give any form or shape, small or big In the sense of modern science and scientists, it is called the desire body Of all the living beings in the whole universe, only man can make a vaikriya body i e desire body, if he performs certain special type of penance or if he attains a certain special type of knowledge, he can make an Āhāraka body besides the Audārika body of bones, flesh and skin, that is visible to naked eyes But never can he simultaneously makes both the types of body - the vaikriya body and the Āhāraka body [14]

Of the five types of body, the types of body intended to be described here are the taijas body and the Kārmana body All living beings in the whole universe certainly have these two types of body Of course, the living being who have emancipated from the bondage of all karmic particles has attained salvation and has got liberation from the eight types of karma, has none of the

five bodies and that is he is called unembodied This taijas-Kārmana body is called the vital body The taijas body, which Śrī Dutt calls the subtle body, digests food and makes constituents of the gross body such as blood, flesh, fat, bones, marrow etc The Kārmana body which Śrī Dutt calls Kārana body, determines various forms and structure of gross and subtle body Both these types of body are very important

In paintings of gods, an aura is painted behind their heads It is a symbol of their divine quality Really speaking, it is an effect of purity of their subtle / taijas body Other living beings and human beings also have such a bright round shape around their bodies, which is called an aura Really speaking this aura is a bio-electro-magnetic field As every magnet has its magnetic field, so every living being has his field of effect The aura of a human being depends on the purity of his taijas / subtle body and that again depends on the auspiciousness of material particles of Kārmana Varganā absorbed by the Kārmana body and their colour, smell, taste and touch The absorption of auspicious and inauspicious material particles depends upon auspicious and inauspicious thoughts conceived by the mind As a result, the intensity and purity / impurity of the aura depends upon the thoughts created in the mind Śrī Dutt calls the aura, the armour of energy The mind which is now-a-days called the sixth sense, is made of constituent units of subtle particles

Though Śrī Dutt is not a Jain, he seems to follow the contentions of Jain philosophy On one hand, this fact justifies the Jain contentions and on the other hand, his extrasensory perceptions being true, convince the Jain community Of course, an extensive analysis as well as classification and research of his experiences, seems to be necessary and his experiences and similar experiences of others may open up a new filed of research

One of his extra-sensory perceptions wonderfully reflects the Jain philosophy of karma He says that particles are encompassed in the armour of energy i e bio - electromagnetic filed The subtle body absorbed them as food It is necessary to analyse this statement from gross as well as subtle view points

On a gross level, Jain philosophers classify food into four types 1 Kavalāhāra, 2 Prakṣēpāhāra, 3 Lōmāhāra and 4 Ōjāhāra 1 Eating with

mouth the cooked food in the form of morsels is called Kavalāhāra 2 Giving energising substances or medicines directly into blood through injections or holes made in skin when it is not possible to take food through the mouth, is called Prakṣēpāhāra 3 Absorbing subtle particles from the atmosphere through short and small hairs on the body, is called Lōmāhāra 4 Sperm of father and blood of mother taken by a child in the womb as food, is called Ōjāhāra

Speaking from a subtle point of view, according to the Jain theory, the soul grasps karma particles, i e paramānu-units of Kārmana Varganā from the space-points which are non - distant from the space-points in which he lives [15] Then the soul incorporates them in his Kārmana body Thus, the soul somehow becomes inseparable from them

Does the extrasensory perceptions of Śrī Dutt suggest Lōmāhāra ? Or does it suggest absorption of paramānu-units of Kārmana Varganā described from a subtle viewpoint ? This cannot be understood Perhaps he did not think of making such a line of demarcation because it seems that it is impossible for him to make such analysis or classification of his experience without a full knowledge of the Jain theory of karma

Regarding the armour of energy i e an aura, he says that the greater circumference of the aura, the greater its capacity for grasping the particles of energy and preventing them from being wasted or going away It can perhaps be said that as the living beings develop spiritually, their energy-armour i e aura becomes larger and clearer That is why the aura of divine beings, gods and goddesses and of Tīrthankara is pure, clear and visible to the eyes Non-living objects can also have such an aura But it is not like the aura of living beings, which is stable and develops according to spiritual progress Day by day, it becomes weaker and weaker and loses its lustre When gods have six months of their life-span left, their aura begins to lose its lustre, their flower-garlands begin to wither and their body becomes dirty But those gods who are Ēkāvatārī, i e who are to take the next birth as a human being and are then to attain the final liberation, are exempted from this rule Their aura becomes more and more lustrous and their flower-garlands do not wither The intensity of the energy-armour (aura) or bio-electromagnetic field, depends upon the capacity of mind and will-power As the will-power of a living being becomes intense, his circle of aura becomes large and intense Man

should, therefore, make his will-power intense by means of constant auspicious thoughts, prayers and worship of God

In order to avoid unnecessary repetition, I will take up the analysis of Śrī Ashok Kumar Dutt's extrasensory perceptions of sound and alphabet, along-with the analysis of his article entitled 'The Secrets Of Sanskrit Alphabet and Sound of Incantation'

References

1 Light is always in the form of electro-magnetic waves Therefore 'light' here means electro-magnetic waves

2 This is a general division or classification More sub-divisions are described in the books on physics

3 अजीवकाया धर्माधर्माकाशपुद्गला ।।१।। द्रव्याणि जीवाश्च ।।२।। कालश्चेत्येके ।।३९।।

ajīvakāyā dharmādharmākāśapudgalāh 1 dravyāni jīvāśca 2

kālaścētyēkē 39 (Tattvārtha Sūtra, Chapter V)

4 रूपिण पुद्गला ।।५।। *rūpinah pudgalāh 5* (Tattvārtha Sūtra Chapter V)

5-6 स्पर्श-रस-गन्ध-वर्णवन्त पुद्गला ।।२८।। *sparsa rasa-gandha varnavantah pudgalāh 28* (Tattvārtha Sūtra Chapter V)

6 Commentary on the aphorism स्पर्श-रस-गन्ध-वर्णवन्त पुद्गला ।।२८।।

sparśa-rasa gandha-varnavantah pudgalāh 28 by Siddhasena Gani (Tattvārtha Sūtra Chapter-V)

7 *Varganā* is a word of Jain terminology It is used for groups of atoms/ *paramānus*

8 Red yellow and blue are the three original colours All other colours are made by mixtures

9 भावओ ण राइभोअणे तित्ते वा कडुए वा कसाये वा अबिले वा महुरे वा लवणे वा ।

bhāvaō nam rāibhōanē tittē vā kaduē vā kasāyē vā ambilē vā mahurē vā lavanē vā (Pakkhisūtra- ālāpaka-6)

10 वण्ण किण्ह-नील-लोहिअ-हलिद्द-सिया ।।४०।।
सुरहिदुरही रसा पण तित्त-कडु-कसाय-अबिला महुरा ।
फासा— गुरु-लघु-मिउ-खर-सी-उण्ह-सिणिद्ध-रुक्खट्ठा ।।४१।।

vanna, kinha nila-lōhia-halidda-siyā 40

surahidurahi rasā pana, titta-kadu-kasāya-ambilā mahurā
phāsā-- guru-laghu-miu-khara-si-unha-siniddha-rukkhatthā 41
(First Karmagrantha, gāthā 40-41)

11 Pyramid Power by Max Toth & Gerge Nielsen

12 Commentary on the aphorism अजीवकाया धर्माधर्माकाशपुद्गला ॥१॥
ajivakāyā dharmādharmākāśapudgalāh 1 by Siddhasena Gani

(Tattvārtha Sūtra, Chapter-V)

13 See 'Science Discovers Eternal Wisdom' by Muni Śrī Amarendravijayji Mahārāja

14 A detailed description of both these types of body is found in Siddhasena Gani's commentary on the Tattvārtha Sūtra, Chapter-2, Sūtra 37 to 49

15 एग पएसोगाढ निअ सव्वपएसो गहेइ जीओ ॥७९॥ *ēga paēsōgādham nia savvapaēsō gahēi jiō 79* (Fifth Karmagranth, gāthā-79)

THE NOTION THAT ALL SCIENTIFIC MODELS AND THE THEORIES ARE APPROXIMATE AND THAT THEIR VERBAL INTERPRETATIONS ALWAYS SUFFER FROM THE INACCURACY OF OUR LANGUAGE WAS ALREADY COMMONLY ACCEPTED BY SCIENTISTS AT THE BEGINNING OF THIS CENTURY, WHEN A NEW AND COMPLETELY UNEXPECTED DEVELOPMENT TOOK PLACE THE STUDY OF THE WORLD OF ATOMS FORCED PHYSICISTS TO REALIZE THAT OUR COMMON LANGUAGE IS NOT ONLY INACCURATE, BUT TOTALLY INADEQUATE TO DESCRIBE THE ATOMIC AND SUBATOMIC REALITY

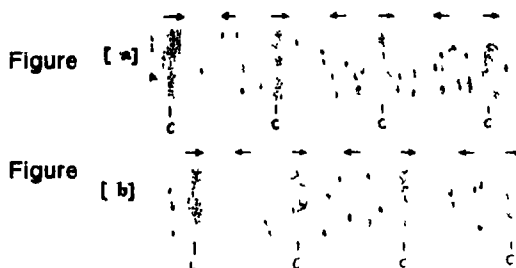
FRITJOF CAPRA

9. Colour : The Wonderful Characteristic Of Sound

In the October- December, 1992, issue of 'The Quarterly' Of Farbus Gujarati Sabha, I read the articles - 'Colour The Wonderful Characteristic Of Sound' written by Urmiben Desai and 'The Secrets Of the Sanskrit Alphabet And Incantation-Sound' written by Śrī Ashok Kumar Dutt I was greatly delighted and astonished to read them Theoretically, the Jain philosophy regards sound as a form of pudgala (matter) Therefore, under no circumstances can the possibility that the sound has colour, can be ruled out But the common man cannot grasp the colour of sound with his eyes As I went on reading Śrī Dutt's article on his extrasensory perceptions, my faith in Jain Philosophy became stronger and stronger

I think that the particle form of light must be accepted for explaining the phenomenon of photo-electric-effect of light and ultraviolet rays and the wave-form of light must be accepted for explaining the fact i e phenomenon of interference of light Similarly, the sound which is fully accepted in the wave form by scientists, is really in the form of particles according to the Jain philosophy And the extrasensory perceptions of Śrī Ashok Kumar Dutt also prove that sound is in the form of particles Therefore in course of time, the dual nature of sound like that of light will have to be accepted As the branch of quantum mechanics has developed in respect of light, a new type of quantum mechanics will emerge in respect of sound An an electronic instrument is invented by scientists for protection against sound-pollution With the help of it an anti-sound is produced against sound The anti-sound goes towards the sound, dashes against it and destroys it It works on the principle of destructive interference [1] For this reason sound must be accepted to be in the form of waves But scientists explain the propagation of sound with the help of particles existing in the medium of air And it is shown as under

When the sound wave passes, the particles in air seem to be pushed very near to one another in certain parts These parts are called crests of sound waves and they are shown by 'c' in the figure These crests move from the left to the right Fig (a) shows the condition of the first moment and Fig (b)

shows the condition of the next moment The portion which has a larger number of air particles i e greater density of medium, is called a crest of the wave or condensation The portion which has a less/low density of medium, is called a trough of the wave or rarefaction This description of *propagation of sound shows that sound is in the form of particles* Jain scriptures also show this method of propagation of sound The only difference is that the particles of medium are replaced there by constituent paramānu-units of Bhāsā Varganā

The ancient Jain philosophical literature[2] and the science of mysticism[3] accept sound only in the form of particles They also show its colours In the modern western literature there is a mention/reference that two or three western scientists have seen colours of sound [4] People like Śrī Ashok Kumar Dutt who have a natural gift of this sort of extrasensory perception, even today are able to see the colours of sound [5]

The Jain philosophy believes that sound is produced by paramānu-units of a matter i e Bhāsā Varganā Every characteristic of an atom i e paramānu is, therefore, present in sound in a subtle form The Tattvārtha Sūtra which is acceptable to all sects of Jains, clearly states that as a pudgala (matter) has colour, smell, taste and touch, so its smallest indivisible part called atom i e paramānu also has colour, smell, taste and touch [6] Therefore as a man with extrasensory perception can see that colour of sound, so other people, having different type of extrasensory power, can perhaps experience taste and smell Everyone experiences the touch of sound The tap-recorder, the gramophone record etc are useful only because sound can be picked by these instruments very clearly, we do experience the touch of a very big sound It is, therefore, not necessary to elaborate on this

The ancient Jain tradition shows that some distinguished ascetics

attained such type of extraordinary or extrasensory powers by virtue of their penance In Jain literature, such extrasensory power is known as a 'labdhi' The book of rituals entitled 'Siddhacakra Mahāpūjana' and 'Sūrimantra' etc mention the names of various 48 types of labdhis Amongst them, there is a special type of labdhi called 'Sambhinnasrōtas '[7] Whoever attains this labdhi, can get through any one of his senses, the knowledge which can be obtained by other senses e g through the sense of touch, he can see, smell, hear and taste Of course, the attainment of such extrasensory power i e labdhi seems to be improbable/impossible in the present day world Some people, therefore, may not believe it, but for this reason it is not proper to make the statement that such extrasensory powers cannot be there

Therefore, the power of direct experience of the colour of sound attained by Śrī Ashok Kumar Dutt, must be some special type of labdhi According to the Jain theory of karma, this extrasensory power of Śrī Dutt, must have been obtained by eradication-cum-mitigation of Matijñānāvaranīya karma because this type of karma covers the knowledge received through the five senses and mind This kind of karma obstructs the direct knowledge received through sense - organs When the cover of this type of karma is removed one naturally receives direct knowledge through sense-organs

Śrī Dutt's extrasensory perception of the colours of Sanskrit letters and the colours of Sanskrit letters shown in the books of ancient tantric/mystic science are not in agreement at many places Moreover, even in the books on tantric/mystic science the descriptions of the colours of Sanskrit letters are not in mutual agreement [8] But these references certainly prove that ancient sages and distinguished tantrikas experienced colours of sound

Śrī Dutt is an engineer in 'Bharat Heavy Electricals Limited ' He has therefore, attempted to analyse his extrasensory perceptions according to scientific methods He has taken pains to determine the colour of every letter He has also tested his experiences of colour of sound by comparing them to the rules of sandhi (euphonic coalition of letters) and dissolution of sandhi in grammar of the Sanskrit language He has also shown the graphic method of showing wonderful power of various mantras and names by well-arranged tables through knowing the different colours of each letter (a vowel or a consonant) of the Sanskrit alphabet and its glitter and intensity

According to him, assemblages of coloured particles produced by sound united with one another and underwent a transformation into an assemblage of particles of a different colour They perhaps followed the rules of sandhi (combination of letters) of the Sanskrit language In his article, he has given illustrations of this transformation On the basis of his experiences he says that the Sanskrit language is very scientific

Really speaking in languages of the world other than Sanskrit, pronunciations do not agree with the letters of a word While in the Sanskrit language pronunciation is in complete agreement with the letters of a word e g The English language has the words - know, now and no The pronunciation of the word 'know' is in complete variance with the letters of the word The letter 'k' is unpronounced (silent) The letter 'w' is also silent In the word 'now', 'o' is pronounced as 'a', that does not agree with the letters The pronunciation of the word 'no' is in accordance with its letters But when the letters of the word 'no' are pronounced separately they are pronounced as 'en', 'o' Thus the sound form of its letters is different from its combined sound form In the English language, pronunciations differ from speaker to speaker Some pronounce 'the' as 'DHEE' (धी) and some pronounce it as 'DHA' (ध), while Hindi speaking people pronounce it also as 'DA' (द) None of these pronunciations agree with the letters - T H E

It is not so in the Sanskrit language In Sanskrit language, words are pronounced as they are written No consonant or vowel is silent in the pronunciation Of course the vowels and the consonants join according to the rules of sandhi and they change their form But the words are pronounced as they are written Not a single letter, vowel or consonant remains unpronounced e g राम अत्र उपविशति Rāmah Atra Upaviśati This sentence is pronounced according to the letters But when the words are joined by the rules of sandhi, the sentence is pronounced as रामोऽत्रोपविशति Rāmō'trō'paviśati In this sentence अ of म is followed by the visrga ( ) and both are changed into ओ because both are followed by a vowel अ Same way अ of त्र and उ of उपविशति, both are changed into ओ Both the ओ are to be surely pronounced, while the vowel अ of अत्र disappears by the rules of sandhi, so it is not pronounced Such strict observance of rules is not known in any other language Of course, the languages derived from the Sanskrit language retain to keep these rules and therefore for a systematic and scientific study of colours of sound, the Sanskrit language is the best medium

Illustrations form the Gujarati language, given by Smt Umiben Desai are as under शेख + चल्ली = शेक्चल्ली, हाथ + कडी = हात्कडी, शोघ + ता = शोत्ता, सूंघ + ता = सूंक्ता, मग+खाधा=मक्खाधा, कूद + को = कूत्को, डूब + तो = डूप्तो, नाग + पुर = नाक्पुर *śēkha + callī = śēkcallī, hātha + kadı = hātkadī, śōdha + tā = śōttā, sūngha + tā = sūnktā, maga + khādhā = makkhādhā, kūda + kō = kūtkō, dūba + tō = dūptō, nāga + pura = nākpura* show that the transformation in the coloured particles of energy, follows the pronunciations and not the letters of words of language

It is a special feature of the pure Sanskrit language that its pronunciations /sounds fully follow the letters (alphabet) That is why the rules of sandhi and dissolution of sandhi of the Sanskrit grammar apply or can be applied to coloured energy particles of sounds of Sanskrit language If there is a hyphen farness between Sanskrit letters or words, sandhi is not permissible Similarly, if sounds of Sanskrit letters of words, are separated, the colour, glitter etc of coloured energy particles do not undergo transformations e g If तत् 'Tat' and श्रुतम् 'Śrutam' are spoken separately, they will not be united by alphabetical sandhi and consequently the coloured energy particles of the तत 'Tat' and श्रुतम 'Śrutam' will not undergo any transformation In short it should be accepted that colours of sound of any sort, follow the pronunciation and not the letters of alphabet

The English language is quite unfit for the study of colours of sounds because the pronunciations of its alphabets/letters except A E and O, have two or more letters Moreover, the pronunciations of words are not at all in accordance with its letters e g The letter 'a' is sometimes pronounced as 'ĕ' as in 'above' Sometimes as 'ā' in 'car' and sometimes as 'ai' as in 'parent' This is probably in the case of every letters of English alphabet The importance of the Sanskrit language that Śrī Ashok Kumar Dutt explains on the ground of his experience is, therefore real It is on account of its strict observance rules that it is accepted as the best computer language

Regarding the word 'Rāma', Śrī Dutt writes in his article "In graphic method the words 'Rāma' and 'Marā' are of equal magnitude and, therefore, there is no difference between their energies " But according to me, this statement is not proper The energy of sound or word does not depend only on the magnitude of its graphic form or written form There are several ways of writing The sequential order of writing letters in the word 'Marā' is reverse to the sequential of writing letters in the word 'Rāma' Though the energy of

the word 'Marā' is equal to the energy of the word 'Rāma', it is of the negative type This is my guess In the science of incantation (मन्त्रविज्ञान), there are different ways of reciting mantras/incantations e g If recited according to the right sequence (पूर्वानुपूर्वी) the Namaskāra Mahāmantra नमस्कार महामन्त्र gives spiritual reward but if it is recited according to the reverse order (पश्चानुपूर्वी) it gives material rewards [9]

Thus on the one hand, Śrī Dutt's experiences of sound strongly support the sound form described in Jain philosophy and on the other hand they raise a question mark about the wave theory of modern science

In conclusion I hope that the scientists of our country will help me in carrying on research in this branch of study

References

1 See 'Abhiyāna' of April 6 1992 Page No 7 8 by Nagendra Vijay

2 सद्दधयार उज्जोअ पभा छायाऽऽतवे हि य । वण्ण गध रसा फासा पुग्गलाण लक्खणम ।

saddandhayāra ujjōa pabhā chāyā 'tavē hi ya

vanna gandha rasā phāsā puggalānam lakkhanam (Navatattava Gāthā-11)

3 4-5 See 'The Quarterly' of Farbus Gujarati Sabha Octo Dece 1992 Bombay page 276 to 288

6 स्पर्श-रस-गन्ध-वर्णवन्त पुदगला ।।२८।। *sparśa rasa-gandha varnavantah pudgalāh 28* (Tattvārtha Sūtra, Chapter V)

7 See Sri Siddhacakra Mahāpūjana Labdhipadapūjana

8 See 'The Quarterly' of Farbus Gujarati Sabha Octo -Dece 1992 Bombay page 276 to 288

9 See 'Yantra' by Madhu Khanna, p 48 and 'Sūrimantra kalpa samuccaya' part II p 360-361

10. Limitations Of Mathematics In Jain Philosophy And Modern Physics

"One of the famous aphorisms of Einstein conveys the same idea - 'As far as the laws of mathematics refer to reality, they are not certain and as far as they are certain they do not refer to reality

Because of this critical limitation of science leading to gross error in perception of reality one of the main aims of eastern mysticism is to rid us of this confusion and to aim at the direct experience of reality which transcends the intellectual thinking "

—D K Satsangi

(Bulletin of Theosophy Science Study Group, India, December 1988 Vol 26 No 6, p 63)

Ever since the beginning of human civilization, mathematics in some form or other has been in use in the society But in modern times, its use has assumed great importance But for the use of mathematics researches leading to human welfare and multiplication of production of things useful to the human race, would never have been possible even with the help of advanced mechanics The advancement in mechanics, basically depends on the use of mathematics [1] It is, therefore, essential to study mathematics for understanding of modern science

While we think of mathematics, a number of questions arise Is mathematics an art or a science? Is mathematics a game of various symbols? Is it still a language? Is it still the Queen' of sciences or it has now been enslaved as their servant'? Wherein resides the soul of mathematics? Is it really a spinal cord of science? What is the motive behind mathematical creations? Like poetry and music how far does it give artistic amusement to people?

All these questions can be answered from various viewpoints All the same, mathematics is only a sort of game of imaginary symbols But this

game can play and does play a very important role in our day-to-day life Mathematics is related to the quantitative aspects of every object We use objects in all our activities Since life consists all activities, various objects are no doubt useful in everyman's life and there is nothing in the world which has no quantitative aspect It follows,therefore, that there can be no life without mathematics [2] Of course, the type and use of mathematics differ in everyman's life according to his own understanding

Mathematics in its modern form differs little from science The only note-worthy difference is that mathematics uses proof ' in place of observation' [3] Mathematics is a basic requirement of modern physics and modern physics explains and tries to explain almost all natural laws and phenomena through mathematics, but as far as physics is concerned, it has failed to explain all physical phenomena through mathematics or to put in mathematical formulae all the laws that cause the phenomena The laws are true only within a certain limit Beyond the limit all mathematical formulae prove to be false They cannot be applied there

Before discussing these limitations of mathematics, let us examine the origin, development and history of uses of mathematics

Types and Uses of Numbers

Pythagoras accepted the so called natural numbers 1 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, etc as gifts from gods and he showed no curiosity to know when and how they came into hands of men [4] These natural numbers have certain properties

1 These natural numbers are mainly of two types Odd numbers and even numbers The distinction between odd and even numbers is untraceably ancient The ancient general belief that odd numbers are lucky and even numbers are unlucky, is widely prevalent in the society even today Similarly, there is a very ancient belief that odd numbers are masculine and divine or heavenly and even numbers are feminine and human or earthy [5]

2 The sum of two even numbers is always an even number Similarly, the sum of two odd numbers is also an even number

3 The sum of odd numbers in sequential order beginning with 1 is always a square [6] e g $1+3=4=2^2$, $1+3+5=9=3^2$, $1+3+5+7=16=4^2$, $1+3+5+7+9=25=5^2$

4 The sum of two natural numbers is always in the form of a different natural number (Zero is not regarded as a natural number because counting always begins with 1 and never with zero) The modern mathematics expresses this thus -- "The set of natural numbers is closed with respect to addition

The concepts of addition of natural numbers was later symbolised as + And that was the first arithmetical operation on them It has the noteworthy property that the sum of two natural numbers is also a natural number greater than each of the two natural number

At initial stages the concept of subtraction implied the removal of smaller natural number from the bigger ones The reverse could not be conceived of for a long time But some one appears to have hit upon the idea of proceeding the other way round He showed this with a practical example Suppose a man has five coins of his own and he has to pay seven coins to some one else He can pay seven coins to other person only after taking a loan of two coins from a third person Thus 5 - 7 = - 2, Here 5 stands for the number of coins that the man possesses as his own - 7 stands for the number of coins that he has to pay to someone as a loan - 2 stands for the number of coins that the man takes as a loan from the third person Thus the negative (- ve) numbers denote debt [8] In short, the new process of subtracting a big number from a small number produced a category of negative (-ve) numbers Compared to the natural numbers, they were unreal and imaginary They were denoted by putting the negative (-ve) sign before natural numbers These imaginary integers in the form of negative natural numbers came to be recognized as a set of negative integers and the real natural numbers in the form of positive numbers along with zero came to be recognised as a set of positive integers [9] These numbers can be arranged in an ascending order as under

(-1000, -900, -100, -90, -50, -10, -9, -7, -4, -1 0, 1, 5 9, 10, 60, 100 1000,)

Natural numbers are also called positive (+ve) integers

A very important point emerges from the similarity of positive and negative integers Every number on the right in the sequence is 1 more than the immediately preceding left one [10]

According to the research scholars of modern age, the development of civilization induced the use of continually increasing big numbers in social transactions The operation of addition was found to be too cumbersome to tackle the complicated problems involving large numbers arising out of expanding business and commerce The concept of multiplication emerged out of the process of giving a short form to the operation of addition It was symbolized as x

In the single set of aforementioned two groups of numbers (positive and negative integers) the product of two numbers of the either group belong to the same group [11]

The product of a positive (+ve) number and a negative (-ve) number is always a negative number In practice, this operation is used to show a quantity of debt e g 5 x (- 4) = - 20 This equation implies that a loan of 4 coins was taken five times If - 4 is added to - 4 five times, the summation will be - 20 The total loan will amount[12] to 20

The method of multiplication was invented as a shortcut to the process of addition for a large scale counting of articles, so the method of division was invented and popularized as a shortcut to the process of subtraction as the joint family system gave way to the system of divided family and it became necessary to separate thing of the parental house into divisions Application of division method to the set of integers proved creative It induced the following concepts regarding to other types of numbers

1 The numbers that could be divided by two came to the called even numbers e g 2, 4, 6, 8, 10, 12 etc

2 The numbers that could not be divided by two, came to be called odd numbers 1, 3, 5, 7, 9, 11 etc

Same way numbers that were divisible by 3, 4, 5, 6, 7 etc and those that were not divisible by them created various classes of numbers

A new class of natural numbers was discovered None of its members could be divided by any natural number other than 1 and itself These numbers are called prime numbers e g 1, 2, 3, 5, 7, 11 13, 17, 19, 23 etc [13]

The division method created a new set of numbers called fractional numbers e g On dividing 1 by 2, 3, 4, 5 etc one gets 1/2, 1/3, 1/4,1/5,

etc Fractional numbers also show the ratio of the divisor to the dividend e g 2/4 = 1/2, 20/4 = 5/1 etc They are, therefore, called rational numbers [14]

Rational numbers are innumerable Even between two consequent integers, there are innumerable rational numbers Besides, there can be innumerable rational numbers even between two rational numbers No two fractional or rational numbers can therefore be said to be quite adjacent This class of rational numbers is, therefore, extremely dense [15] Since all integers are divisible by 1, they are also called rational numbers Regarding fractional rational numbers it should, however, be noted that the divisor is not zero

The idea of square-root emerges from the so called Pythagoras theorem 'So called' because Indian mathematicians had detailed practical knowledge of this theorem centuries before the birth of Pythagoras [16] It is believed that among the forty-five Jain canonical scriptures Sūryaprajñapti, Camdraprajñapti, Jambūdvīpaprajñapti etc relating to mathematics, were orally communicated by Lord Mahāvīra during the period between 557 B C to 527 B C There square-root is named as Karanaprakriyā and it has been widely used Moreover $\sqrt{10}$ was widely used as gross value of π pi [17] A Jain Ācārya named Ācārya Vīrasēna used 355/113 instead of π pi Śrīnivāsa Rāmānujan, the modern mathematician found out this as late as in the nineteenth century [18]

If two sides of a right-angled triangle have the length of one unit of measurement, the length of its diagonal is $\sqrt{2}$ A number of attempts have been made to find the exact value of $\sqrt{2}$ but in vain Similarly, the exact values of $\sqrt{3}, \sqrt{5}, \sqrt{6}, \sqrt{7}$ etc can also not be found Nor can these numbers be shown by the ratio of two natural numbers These numbers are, therefore, called irrational numbers Like the numbers shown above $\sqrt[3]{2}\ \sqrt[3]{3}\ \sqrt[4]{2}\ \sqrt[4]{3}$, etc are also called irrational numbers [19] A number of attempts have been made to find out an estimated approximate value of these irrational numbers These irrational numbers fall somewhere between two rational numbers Only this can be determined [20] All these rational and irrational numbers are collectively commonly called Real numbers [21]

Proceeding further, we come across yet another class of numbers, called complex Numbers Square roots, forth-roots etc of negative numbers are very useful in these complex numbers Really speaking the square-roots, the fourth roots or sixth-roots of negative numbers have imaginary existence Mahāvīracarya, the Jain mathematician of the ninth century of A D, was the first to call them imaginary [22] Later on in the year 1545 A D the mathematician named Cardon also called them imaginary Of course, these numbers are used in mathematics in the following way

e g $40 = 25 + 15 = 5^2 - (\sqrt{-15})^2 = (5+\sqrt{-15})(5-\sqrt{-15})$

Here $(5+\sqrt{-15})$ and $(5-\sqrt{-15})$ are called complex numbers Since there is no real number in mathematics whose square can be a negative number it is not possible to find out the real value of $\sqrt{-15}$ and therefore it is called imaginary

Zero - The Eternal Enigma

Zero is a unique gift of Indian mathematicians to the world Of course who invented zero? How? All this cannot be definitely decided But we can make inferences

We make a dual use of zero- as a symbol and as a number In the initial stage, zero was used as a symbol Zero is used to show total absence of a thing Formerly, Indian writers used words and letters to indicate numbers and figures Then figures 1, 2 3 4, 5, etc were used as symbols for those words Along with the words, these figures i e numbers were also written between brackets e g (3, 5, 6, 1, etc) But when total absence of a thing was to be shown, a point was put between brackets along with the word standing for sky ( ) This is what some believe [24] This symbol ( ) showed a null set or null vector [25] As time passed by, the point, it is inferred dropped out of the brackets and only brackets were used Which people wrote the symbol of brackets hurriedly, they perhaps joined the brackets together And this is how today's form of zero came into being It is my inference that zero was thus created It showed total absence of a thing Then after a very long period of time it was accepted in the form of number After acceptance of zero as a number it was again a question to place zero in the order of numbers Generally, in computers and typewriters zero is placed after 1, 2 3, 4, 5,

6, 7, 8, 9 Here we can see that if we count the numbers from 1 to 9, from left each consecutive number to the right is greater by 1 Though zero was placed after nine It is not greater than nine Therefore, in an arithmetical series, zero is placed before 1 and after -1

There is a book of Pingala on prosody It was written perhaps in the second century B C It was found in that book that zero was for the first time used as a symbol Also in the book of Jain Ācārya named Jinabhadrasūriji zero is used as a symbol of emptiness [26]

Mathematics In Ancient India

Like the top crown of the peacock like the valuable pearl or the mountain peak, mathematics occupied the most, superior status in the Vēdāngas [27]

- Vēdānga Jyōtisa

The most significant source of information regarding the ancient Indian culture is the four Vēdas Of course European researchers and Indian researchers are not all of the same opinion regarding the time of composition of Vēdas [28] But all agree that Vēdas are more ancient than any of the Western civilizations and there is no doubt about it

Archaeological relics of Mohan-Jo-Doro and Harappan etc belong to what we call the Indus (Sindhu) valley civilization and that is the Hindu Civilization which is believed to be the most ancient According to the researchers, Vedas appear to have been composed a little later than 3000 B C Vedas and other literary works were preserved for centuries in oral tradition, i e the tradition of listening and memorizing, They are therefore also called 'Srutis' Brahmin literature appears to have been composed in the vicinity of 200 B C

First glimpses of mathematics are visible in the Brahmin literature Evolution of arithmetic, geometry and astronomy is discernible from them Vēdāngas and mathematics relating to astronomy dealt with in Vēdāngas were composed during 2000 B C to 1500 B C In those days, there were mainly two divisions of knowledge

1 Parā-Vidyā which fully dealt with spirituality and 2 Aparā-Vidyā which dealt with secular prescriptions, prohibitions and rituals Mathematics and other sciences formed parts of Aparā-Vidyā and they were

considered to be helpful to spiritual knowledge [29]

In discussions in Chāndōgya Upanisad mathematics was spoken of as *Rāśividyā (the knowledge of quantity) and astronomy was spoken of as* Naksatravidyā (the knowledge of planets) Mathematics is their English name The popular name of mathematics in India has continued to be 'Ganita' since ancient times [30]

Researchers today believe that the familiar numerals including zero and the decimal system were invented, applied and put on solid foundation during 400 B C to 400 A D [31] In those days geometry was called field arithmetic and arithmetic was called 'Dhūli-Ganita', 'Dhūli-Karma' or 'Pāṭī-Ganita' [32]

It is strange but true that from the beginning of their numerical thinking, ancient Indian mathematicians used ten as the base for counting Even before the process of writing was invented, Indians used very large numbers with ten as base These numbers are one (1), ten (10), hundred (100), thousand (1000), ten thousands (10,000) etc upto a hundred thousand billions[33] (100,000,000,000,000,000)

In an ancient book entitled 'Lalita-Vistarā', we find 100 fold series The book was composed in about 100 B C [34]

In ancient times, almost all treatises written on mathematics as well as the literature on other subjects was written in verse That is why letters *of alphabets, symbolic words used in Sanskrit[35] or words directly used for* numbers namely one, two, three etc [36] are mentioned in verses

The words sun, moon, Brahma, earth etc were used for 1 Eyes, ears nose, hands feet were used for 2 Tenses, worlds, Guna etc were used for 3 Similarly different words were used for four five, six seven, eight, nine etc Zero was represented by the sky and its different synonyms According to the rule अङ्कानां वामतो गतिः (ankānām vāmatō gatih) the number, 1230 can be shown in words by using the words kha(ख), guna(गुण), nētra(नेत्र), sūrya(सूर्य) (0,3,2,1)

Even today eulogical articles and documents and in the colophons of manuscripts written in Sanskrit prose or verse literature, the year of writing, the year of composition, the day of writing etc are mentioned in this way

According to references of the ancient available treatises the following books of 'Pātī-Ganita' are extant [37]

1	Baksalī Manuscript		- Second Century
2	Bhāskara-1	Laghu-Bhāskarīya, Mahā-Bhāskarīya	sixth Century
3	Śrīdhara	Trisastika	750 A D.
4	Mahāvīra	Ganitasārasangraha	850 A D.
5	Śrīpati	Ganita Tilaka	1039 A D.
6	Bhāskara-2	Līlāvatī	1150 A D
7	Nārāyana	Ganita Kaumudī	1356 A D
8	Munīśvara	Pātīsāra	1658 A D

Moreover, the following books on Astronomy or Astrology containing one or more chapters on Pātī-Ganita are extant [38]

1	Sūryasiddhānta	-	300 A D
2	Āryabhatta-1	Āryabhaṭṭīya	499 A D
3	Varāha Mihira	Pañcasiddhāntatikā -	505 A D
4	Brahmagupta	Brahma-Sphuṭa-Siddhānta	628 A D
5	Āryabhatta-2	Mahā-Siddhānta	950 A D
6	Śrīpati	Siddhānta-Śēkhara	1039 A D
7	Kamalākara	Siddhānta Tattva Vivēka	1658 A D

Jain Canonical Scriptures and Mathematics

Every religion irrespective of its name, is divisible into two distinct and distinguishable aspects of its manifestations (1) the spiritual aspect and (2) the aspect of worship of karma Almost all spiritual doctrines can be abstractly traced in the properties of mathematical concepts of zero and infinity, signifying respectively the beginning and the end of all creations [39] The following verse of the Īśāvāsyōpanisad reflects the concept of spiritual perfection as well as the concept of infinity

ॐ पूर्णमदः पूर्णमिदं, पूर्णात् पूर्णमुदच्यते । पूर्णस्य पूर्णमादाय पूर्णमेवावशिष्यते ।।

OM pūrnamadah pūrnamidam, pūrnāt pūrnamudacyatē
pūrnasya pūrnamādāya pūrnamēvāvaśisyatē

(This is a whole That is whole Whole can be obtained from whole and if whole is completely taken out of a whole, only a whole remains)

The concepts of innumerable and the infinite in Jain mathematics also represent this same concept Innumerable numbers have innumerable types or divisions If an innumerable number is subtracted from an innumerable number, what remains is an innumerable number Similarly, if an infinite number is subtracted from an infinite number, what remains is an infinite number because an infinite number has infinite types or divisions

Bhagavān Mahāvīra and Gautama Buddha respectively founded the Jain religion and the Bauddha religion before 527 B C, gave their sermons and propagated their religious doctrines

Jain canonical literature is divided into four sections

1 Dravyānuyōga

2 Ganitānuyōga

3 Caranakaranānuyōga

4 Dharmakathānuyōga

Jambūdvīpaprajñapti Sūryaprajñapti, Candraprajñapti, Dvīpasāgara-prajñapti etc Jain Āgamas and other treatises like Laghuksētrasamāsa Brhatksētrasamāsa Laghusangrahanī Brhatsangrahanī and Jyōtisakarandaka etc belong to the Ganitanuyoga section Jain Ganita i e Jain Mathematics of those days can be divided into two sections[40]

1 Ganitānuyōga - Mathematical Doctrines

2 Sankhayāna - Science of Numbers

Similarly, mathematics found in the Buddhist literature can be divided into three sections -

1 Mudrā - i e Arithmetic of Finger

2 Ganana - i e Mental Arithmetic and

3 Sankhayāna - i e Higher Arithmetic[41]

The Jain canonical scriptures entitled 'Jambūdvīpaprajñapti' shows a numeral of Jain arithmetic Of course, it has base of ten After the

numbers 84 lakhs, Jain literature shows the base of 84 lakhs along with base of 10 and there are 36 numerals with the base of 84,00,000 Transforming the number into one with a base of ten, we get a number of 250 digits In Jain scriptures this number is called a ' Śīrsaprahēlikā' [42]

2500 years ago, Jain scripturisits showed this large number We cannot even imagine it Even the modern simple computers take nearly as long as two hours to arrive at the 70 digits of 84^{36} In ancient times, omniscient beings of the status of Bhagavān Mahāvīra mentioned such a large number very naturally and without any mistake It is noteworthy here that such a large number was preserved unmistakenly in the oral tradition for 980 years from the times of Lord Mahāvīra to the times of Śrī Dēvarddhigani Ksamāśramana Later on, when Jain canonical scriptures came to be written in scripts this number also found its place in them

In short, modern researchers and historians believe that zero and the decimal system were invented during 200-100 B C [43] but according to the statement of Upādhyāya Śrī Vinayavijayajī the commentator of the Kalpasūtra, when Bhagavān Rsabhadēva taught the practical custom of a householder, he also taught mathematics [44] Therefore mathematics of Indian tradition is billions-billions of years old Similarly it is believed that the set theory was invented by George Cantor But on seeing the references in the Prakrit scriptures of Jainism one clearly finds that the set theory was originally used in the Jain tradition by Jain writers for their understanding and explanation of Karma theory [45]

The Jambūdvīpaprajñapti, the Sūryaprajñapti, the Candraprajñapti, the Dvīpasāgaraprajñapti and other Jain canonical scriptures show the methods of finding out the volume of mountains etc along with the simple methods of finding out the circumference and area of the Jambūdvīpa with its diameter Thus we also find field arithmetic i e geometry in Jain canonical sctiptures Of course, this geometry is of the kind of plane geometry of Euclid

Jain numerical system divides numbers into three divisions - 1 Numerable 2 Innumerable and 3 Infinite Of numerable numbers there are three subdivisions

(1) the lowest numerable (2) the intermediate numerable and (3) the highest numerable In Jain tradition one is not regarded as a numerable

number Counting begins with number two[46] Therefore, two is called the lowest numeral Then the numbers from three onwards to the number which is less than the lowest innumerable number by two are called intermediate numeral numbers The number which is less than the lowest innumerable number by one is called the highest numerable number We can know the highest numerable number, if we know the lowest innumerable number It is very difficult to know which and how many digits the lowest innumerable number has Jain canonical scriptures show one method for this But with the help of it nobody has yet arrived at the number of digits But the number must be much larger than one Sīrsaprahēlikā which consists of 250 digits One Sīrsaprahēlikā = $(84,00,000)^{36}$ =187,955,179,550,112,595,419,009,699,813,430,770,797,465,494, 261,977 747 657,257,345, 718, 6816 x 10^{180} We cannot even imagine the digits of the lowest innumerable number

Innumerable numbers are of nine kinds (1)the lowest Paritta Asankhyāta, (2) the intermediate Paritta Asankhyāta (3) the highest Parítta Asankhyāta (4) lowest Yukta Asankhyāta, (5) the intermediate Yukta Asankhyāta (6) the highest Yukta Asankhyāta (7) the lowest Asankhyāta Asankhyāta (8) the intermediate Asankhyāta Asankhyāta (9) the highest Asankhyāta Asankhyāta[47]

Similarly, infinite numbers are of nine kinds They are as follows (1) the lowest Paritta Ananta (2) the intermediate Paritta Ananta (3) the highest Paritta Ananta (4) the lowest Yukta Ananta (5) the intermediate Yukta Ananta (6) the highest Yukta Ananta (7) the lowest Ananta Ananta (8) the intermediate Ananta Ananta (9) the highest Ananta Ananta[48]

Regarding Jain mathematics Sarju Tiwari writes - "The Jain philosophy of ahimsā (nonviolence) was totally opposed to the sacrificial cult of the Hindus They developed geometrical concepts in their own way The Jain cosmography conceived the shape of the universe, the mountains and the continents as trapezia They used simple and short mathematical methods Their assumption of the circular orbits of the heavenly bodies such as the Sun, the Moon, the Mars etc and the circular shape of the earth, led them to study the property of circles and parallelograms Their studies enabled them to evaluate the value[49] of π as $\sqrt{10}$ "

The book written in English by Śrī Śankarācāryaji entitled 'The Vaidic

Mathematics' gives 16 formulae in Sanskrit based on ancient Vēdas These formulae are very significant If the sūtras are very well understood and properly used, they can be very easily used for solving problems of any branch of mathematics

References to these formulae or sūtras shown in 'The Vaidic mathematics' are also found in ancient Jain scriptures In the commentary on the Jain Āgama entitled 'Śrī Nandisūtra', the functions of these sūtras are described as 'parikarma' The context of the scripture is as under

" सूत्रादि पूर्वगतानुयोगसूत्रार्थग्रहणयोग्तासम्पादनसमर्थानि परिकर्माणि यथा गणितशास्त्रे-- सङ्कलनादीन्याद्यानि षोडश परिकर्माणि, शेषगणितसूत्रार्थग्रहणे योग्यतासम्पादनसमर्थानि यथा गणितशास्त्रे गणितशास्त्रगताद्यषोडशपरिकर्मगृहीतसूत्रार्थ सन् शेषगणितशास्त्रग्रहणयोग्यो भवति, नान्यथा, तथागृहीतविवक्षितपरिकर्मसूत्रार्थ सन् शेषसूत्रादिरूपदृष्टिवादश्रुतग्रहणयोग्यो भवति, नेतरथा तथा चोक्त चूर्णौ-

परिकर्मेति योग्यताकरण जहा गणियस्स सोलस परिकम्मा, तग्गहियसुत्तत्थो सेसगणियस्स जोगो भवइ एव गहियपरिकम्मसुत्तत्थो सेससुत्ताइ दिट्ठिवायस्स जोगो भवइ त्ति ।"

"sūtrādi pūrvagatānuyōgasūtrārthagrahanayōgtāsampādanasamarthāni parikarmāni yathā ganitasāstrē – sankalanādinyādyāni sōdasa parikarmāni sēsaganitasūtrārthagrahanē yōgyatāsampādanasamarthāni yathā ganitasāstrē ganitaśāstragatādya sōdasaparikarmagrhitasūtrārthah san sēsaganitaśāstragrahanayōgyō bhavati nānyathā, tathāgrhita vivaksitaparikarmasūtrārthah san śēsasūtrādirūpa drstivādasrutagrahanayōgyō bhavati, nētarathā, tatha cōktam cūrnnau

parikarmēti yōgyatākarana jahā ganiyassa sōlasa parikammā taggahiyasuttatthō sēsaganiyassa jōgō bhavai ēvam gahiyaparikammasuttatthō sēsasuttāi ditthivāyassa jōgō bhavai tti "

(Commentary on Nandīsūtra by Malayagiri published by Āgamōdaya Samiti, Surat, p 238)

Also in the Nandīsūtra Cūrni (in the Prakrit language) which was written earlier than the aforementioned commentary on the Nandīsūtra, these references are found This means that ancient Jain Ācāryas were well-versed in various branches of mathematics It will be pertinent here to note that these sūtras are said to belong to the Vaidic mathematics not simply because they are found in Vēdas but it should be accepted that

these doctrimes of pure mathematics, which were more ancient even than the Vēdas, were profusely used in the Vēdas This means that this kind of mathematics had fully developed in India before it took birth in the culture of western countries or civilizations

According to the belief of Śrī Śankarācārya of Kanchi, the author of Vedic Mathematics, the functional use of the sūtras was not limited only to arithmetic i e multiplication division, addition or subtraction but they were equally useful in algebra, geometry, trigonometry, calculus etc According to the opinion of Dr P C Vaidya this is only a statement There is not any reference about the use of these sūtras regarding to various branches of mathematics

Limitations of Mathematics In Jain Philosophy

Though mathematics is essentially an imaginary subject, it was invented and developed to satisfy human needs The chief aim of Jain philosophy is to explain the nature of the universe and Samsāra i e birth-death cycle and mathematics is used as a practical means of doing it

The universe has a limit But what is the limit? How many things and what kinds of things does it contain? Mathematics is the shortest way of expressing all this In the universe there are infinite atoms (paramānus) and objects In order to show the number and real nature of them mathematically, 'Śīrṣaprahēlikā' a number of as many as 250 digits, is used As shown in Jain Āgama entitled 'Jambūdvīpaprajñapti' 'Sīrsaprahēlikā' has two different sets of digits according two different traditions According to the tradition of the convocation of learned Jaināčāryas and monks held in Mathurā i e Māthurīvācanā, there are 194 digits, consisting of 54 different figures and 140 zeroes But according to the Vallabhīvācanā, there are 250 digits consisting of 70 different digits and 180 zeroes According to the Māthurīvācanā 'Śīrsaprahēlikā' has $(84,00,000)^{28}$ = 758,263,253,073, 010,241,157,973,569 975,696,406,218, 966, 848,080,183,296, $\times 10^{140}$ digits But according to the Vallabhīvācanā 'Śīrsaprahēlikā' has $(84,00\,000)^{36}$ = 187,955,179, 550,112,595,419, 009, 699,813,430, 770,797, 465, 494, 261,977, 747,657, 257, 345,790,6816$\times 10^{180}$ digits Since it is not possible to mention the number of all the substances of the universe even with this number, Jain scripturists have shown various kinds of innumerable and infinite numbers An 'Āvalikā' has as many 'Samayas'

A page from a manuscript of Jambūdvīpaprajñaptisūtra written in 1663 of Vikram Era, mentioning both the variations of Śīrsaprahēlikā the ancient highest numerical value

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as the quantitative value of the lowest yukta Asankhyāta number [50]

According to Jain philosophy a 'Samaya' is the most micro unit of time 'Āvalikā' is also a unit of time In a Muhūrtta i e in 48 minutes, 1,67,77,216 Āvalikās pass by [51] In one Āvalikā i e 0 000171661 seconds as many as the lowest yukta Asankhyāta i e

$(\text{the lowest paritta Asankhyāta})^{\text{the lowest paritta Asankhyāta}}$ number of Samayas pass by Samaya is the so subtle that even great souls possessing a high degree of Avadhijñāna (extra sensory knowledge) cannot know it Along with the subtlest measure i e unit of time, Jain scripturists also have given the highest measure i e unit of time Since the highest unit of time is also outside the limit of mathematics of Jain scripturists, it can be explained only through comparisons

Of these, important greater units of time the smallest is 'Palyōpama' It consists of an innumerable number of years 10 Kōdākōdī means 10 crore-crore i e 10^{15} Palyōpama years equal to a Sāgarōpama years and 10 kōdākōdī i e 10^{15} Sāgarōpama years are equal to an Utsarpinīkāla or an Avasarpinīkāla Utsarpinīkāla and Avasarpinīkāla together make a Kālacakra i e time-cycle [52] Infinite time-cycles passed by in the past and infinite time-cycles will pass by in the future The Palyōpama, the Sāgarōpama and the time-cycle have a fixed number of years But since it is not possible to show it mathematically, the word 'Asankhyāta' i e innumerable is used

As a Samaya is the samallest unit of time, so a space-point is the smallest unit of length A space-point is a division of space, occupied by an independent paramānu i e atom which is the indivisible most micro-particle of matter In short, the size of an independent paramānu, is a unit of length, breadth or thickness Innumerable such paramānus joining together grossly make a unit of the most micro sub-atomic particle, accepted by the modern science But the longest/largest unit of length is a Rajju or Rājalōka A Rājalōka is equal to innumerable Yōjanas and one Yōjana is equal to 3200 miles or 5120 kilometres Though the measurement of a Rājalōka is limited and definite, it is so big that it cannot be represented through numbers or mathematical equations and therefore, the word Asankhyāta i e innmerable is used to represent it

It is a special characteristic of Jain mathematics that negative numbers

are not at all used Since Jain scriptures describe real objects, which are all existent, positive numbers are used for them Dr P C vaidya says that since modern mathematics is logically constituted and developed, the negative numbers in it, are real and there are also some references to show that they were first used in India during the years 400 A D to 600 A D They are used to mention imaginary matters and objects

Limitations of Mathematics In Modern Physics

(1) Limitations of imagainary doctrines of mathematics

Mathematics is the basic and fundamental necessity of modern physics because modern physics explains or tries to explain all natural laws and phenomena through the medium of mathematics But to the recent period, physics fails to explain fully through mathematical equations all physical phenomena and the laws that cause the phenomena The mathematical equations that it gives, are true only to a certain limit Beyond the limit all the mathematical equations seem to be untrue and useless

Regarding this Dr P C Vaidya gives his criticism that since mathematics is a branch of knowledge based on logic, there is no question whether the mathematical equations are true or not There is only a question regarding to mathematical equations whether they can usefully or effectively indicate the laws of all natural phenomena

The reason for this is that though mathematics is no doubt true the man who uses it, has only a limited imaginations and though some of the assumptions that he makes, are mathematically true, prove to be untrue and unreal in practical life They are creations of the world of imagination

In modern mathematics, negative numbers, their multiplications, divisions and all that is imaginary e g -4/-4 = 1 and (-5)x(-5) = 25 Though mathematically, they are true, they have no practical utility A product of a positive (+ve) number and a negative (-ve) number is always a negative number This appears to have come from practical experience It shows the total amount of loan e g 5x(-4) means that a loan of four coins was taken five times This amounts to a total loan of 20 coins If -4 is added to it self five times, the result will be -20 It means that the total loan is 20 coins

Similarly, the product of two negative (-ve) numbers is always positive (+ve) Cardon H (1501-1576) stated this rule in 1545 A D [53] The origin or source of this rule can be traced back perhaps to the rules of Sanskrit grammar The rules of Sanskrit grammar are called Nyāyas In the book written in the Vikram samvat 1515 i e 1459 A D and entitled 'Nyāya-Sangraha', a collection of some rules from Siddhahēma sanskrit grammar, Upādhyāya Śrī Hēmahansa Gani, the author gives the rule, द्वौ नञौ प्रकृतमर्थं गमयतः ।। *dvau nañau prakrtamartham gamayatah* (Two negatives make one positive) 'If in a sentence, two negatives are used together, they give a positive meaning' [54]

The mathematical rule regarding the product or division of two negative numbers, makes it very clear that it is not necessary that mathematics should be tied down to social transactions Really speaking, mathematical imagination creates concepts beyond practical requirements of time But it is certainly true that such pure creations of mathematical minds have no practical use in the beginning It often happens that for centuries such creations of imaginative mind remain on paper like dry rules [55] In the early seventh century, Brahmagupta stated some rules of signs They became common in India in the ninth century A D after their restatement by the mathematician named Mahāvīracarya [56] However, no free use of negative numbers was made until the seventeenth century Even Cardon had called them 'fictitious' [57]

(2) Limitations of Zero

As a symbol, zero denotes total absence of objects but when it came to be used as a number, ancient mathematicians made some rules Especially, the position and value of zero were determined in additions, subtractions, multiplications, divisions and denotation of numbers Generally, zero as the first figure on the right has no value But if a number other than zero is placed before zero It is not without a value If a number other than zero is placed before it, in the place of tens the value of zero is tenfold Similarly, if a number other than zero is placed before it, zero in the place of hundreds, thousands etc, its value rises ten-ten times Similarly, the value of zero after a decimal point, if it is followed by a number other than zero, reduces tenth-tenth times It means that zero has no definite value Its value depends on its place in a number

In additions and subtractions, too, zero has no value If zero is added to or subtracted from any number, the original number remains quite unchanged But in multiplications and divisions, the rules of zero are very strange If zero is multiplied by any number or any number is multiplied by zero, the product is always zero Similarly, if zero is multiplied by zero, the product is only zero

The strangest fact about the operation of division is that if any number is divided by zero, the result is infinity but if zero is divided by any number, the result is zero If any number is divided by itself, the result is one (1) What would be the result if zero is divided by zero? Zero, one or infinity? Mathematicians have not been able to answer this question They show that the operation of dividing zero by zero is indeterminate

Similarly, a number raised to degrees namely, square, cube, fourth degree, fifth degree etc and similarity, reduced to roots namely square root, cube-root, fourth root, fifth root of zero, it is always zero i e 0^2, 0^3, 0^4, 0^5 $0^n = 0$ and $\sqrt{0}, \sqrt[3]{0}, \sqrt[4]{0}, \sqrt[5]{0}$ $\sqrt[n]{0} = 0$ Any number raised to zero degree is always 1 e g 1^0, 2^0, 3^0 4^0, $a^0 = 1$

What would be the result if zero is raised to zero degree? Zero or one? This question has also remained unanswered by mathematicians and they say that zero raised to zero is indeterminate Really speaking a^0 i e Zero degree of any number means any number is divided by itself and that is why the result is always 1 and 0^0 is indeterminate and all mathematicians accept this result

There is a strange fact about zero, with the help of which any two unequal numbers can be proved to be equal e g 3x0 = 0 and 5x0 = 0

3x0 = 5x0 (I)

or

3/5 = 0/0 (II)

But it is a strange fact that we can also deduce that

0/0 = 5/3 (III)

From II and III we obtain 3/5= 5/3 i e 9=25

If 0/0=1,from II and III, we can deduce that 3/5 =1 and 5/3 =1,

5 = 3

Of course, all these are mathematical funs In practical life the mean nothing

As shown above the uses of zero also has a limit Beyond the limit, it is useless or misleading

(3) Limitations Of Mathematics In The Equations Of Modern Physics

Mathematics is the chief base of modern physics All the rules of physics have been mathematically transformed and the scientists today are also accustomed to talk in the language of mathematics No new research is accepted at the international level unless it is mathematically transformed, explained or proved Sometimes it also happens that mathematical research is made and its proof is given and later on after many years, its practical proof is obtained Still however, on account of limits of mathematics itself, it has become necessary to make changes in mathematical equations of rules explaining various phenomena of physics, happening in the world every year First among them are Newton's laws of dynamics and laws of gravitation

Newton's laws of dynamics and gravitational force are quite true, when applied to objects on the earth But when they are applied to astrophysics, the results are found to be wrong Einstein corrected the mistakes by applying his Special Theory of Relativity and General Theory of Relativity But as later researches show, perfectly true results were not achieved even then

Though gifted with sharp intelligence and extraordinary imagination, Einstein was after all a man In the days when aeroplanes were only invented and they could fly at the speed of only 80 or 100 miles/ hr , Einstein imagined that these physical objects were capable of flying at the speed of light and this was really astonishing Today, there are supersonic planes in the world They and spaceships travel at the speed of 25 to 30 kms per second at the most This speed is ten thousandth part of the speed of light Some of the sub-atomic particles travel at the speed of 150 kms/sec Their speed is 2000th part of the speed of light Of course, the subtle Beta particles can travel at the speed of 0 99 c i e 297000 kms/ sec [58]

It must be admitted that Einstien had a wonderful imagiation but as far as the physics is concerned, the equations of mass, length and time for the moving objects and addition of vectors depending on his Special Theory of Relativity are true only to a certain limit Beyond the limit, the equations prove to be untrue or they are not applicable or useless The equations are as under[59]

(1) $m_v = \dfrac{m_o}{\sqrt{1-v^2/c^2}}$ (2) $\Delta T = \Delta t\sqrt{1-v^2/c^2}$

(3) $L = L'(\sqrt{1-v^2/c^2})$ (4) $\vec{V} = \dfrac{\vec{V}_1+\vec{V}_2}{1+\dfrac{\vec{V}_1 x \vec{V}_2}{C}}$

The postulates of Einstein's Special Theory of Relativity are as under

1 The velocity of the object which produces light has no effect on the velocity of its own light In that sense, the velocity of light is constant

2 No object in the world can attain more velocity than the velocity of light[60]

Einstein's Special Theory of Relativity, General Relativity and other inventions are based on these two postulates The aforementioned formulae cannot be applied to objects which have greater velocity than light because here v is grater than c and therefore, the value of v^2/c^2 is greater than 1 and $1 - v^2/c^2$ has a negative(-ve) value Therefore, the value of $\sqrt{1-v^2/c^2}$ given in the formula mentioned above cannot be obtained or it is only imaginary In the fourth formula even if V_1 and V_2 are greater than c, their addition is always less than c

Regarding Newton's laws of gravitation there is a formula $F = G\dfrac{m_1 \bullet m_2}{d^2}$

where F stands for the force of gravitation, m_1 is the mass of object No 1, m_2 is the mass of object No 2 and d is distance between the two objects The gravitational force between any two objects in the universe is directly proportional to the product of their masses and inversely proportional to the square of the distance between them Supposing that the distance between the two objects is reduced to zero the gravitational force

between them would be infinity But in practical experience, even if the distance between two objects is reduced to zero, the gravitational force between them does not rises to infinity

Thus every mathematical equation in physics can give satisfactory solution only to a certain limit Thereafter, equations cannot be used

What was called field arithmetic in ancient times, is now called geometry Since childhood, we know Euclid's geometry which is known as plane geometry Still however, its propositions do not accord with our perceptions of touch or sight The parallel straight lines of Euclid's geometry, never meet Their existence can be proved by prolonging them on both sides as far as possible They do not accord with what we see with our eyes We can never see such parallel straight lines Though rails of a railway are parallel, they seem to meet after a very long distance in both directions Similarly parallel straight lines seem to meet at the point of intersection of the lines of our eye-sight Euclid's straight lines simultaneously meet at only one point but not at more than one point Euclid's definitions and meanings of straight lines and parallel lines cannot be applied to visual geometry All these difficulties were remedied by initiation of a new geometry, the projective geometry through new mathematical concepts [61]

It was finally established after the publication of Einstein's General Theory of Relativity (1915) that many results of Euclidean geometry considered by past generations as eternal truths were not fully correct These could be at best described as approximately correct

Curved space on all sides of celestial bodies which have a strong gravitational force according to Einstein's General Theory of Relatively, initiated quite a new kind of geometry, Riemannian geometry which was quite different from Euclidean geometry [62]

Thus the rules of arithmetic, algebra, geometry and mathematics are not only imaginative or symbolic but also they are very useful in day-to-day life Still however they have not been able to explain the true reality of the universe That is why Einstein, the talented physicist said, "As far as the laws of mathematics refer to reality, they are not certain and as far as they are certain, they do not refer to reality " It means that if we think of mathematical laws in the context of reality the rules are not definite

or perfectly true and if we accept the mathematical rules as perfectly true, they do not accord with reality It means that they cannot be applied everywhere in the world of reality

In short there are many phenomena of the physical world which openly violate the rules of physics represented in the mathematical formulations Besides, some physical, material and all spiritual phenomena are also beyond the laws of physics interpreted through mathematics Let us wish and hope to be capable of representing all the physical, material and spiritual phenomena through a single mathematical law which is beyond the limits of time, space and matter

2nd December 1997
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IF PHYSICS LEADS US TODAY TO A WORLD VIEW WHICH ESSENTIALLY MYSTICAL, IT RETURNS, IN A WAY TO ITS BEGINNING, 2500 YEARS AGO WESTERN SCIENCE IS FINALLY OVERCOMING THIS VIEW AND COMING BACK TO THOSE OF THE EARLY GREEK AND EASTERN PHILOSOPHIES THIS TIME HOWEVER, IT IS NOT ONLY BASED ON INTUITION, BUT ALSO ON EXPERIMENTS OF GREAT PRECISION AND SOPHISTICATION, AND ON A RIGOROUS AND CONSISTENT MATHEMATICAL FORMALISM

FRITJOF CAPRA

11. The Value of π

No student of mathematics (geometry) is unfamiliar with the number π (pi) If asked, any student will say that its value is 22/7 or 3 14 A brief history of π is presented here

The ratio of the circumference and the diameter of a circle is always constant whether, the circle is small or big This fact was known even in ancient times Greek mathematicians developed mathematical proofs of this This ratio which is generally denoted by the Greek letter π (pi) has an approximate value of three For a very long time this value of π was in use

π is an irrational number An irrational number is a number whose definite value can be denoted by indefinite /innumerable digits following the decimal point $\sqrt{2}$ is also an irrational number Though π and $\sqrt{2}$ are both irrational numbers, there is a basic difference between them He who knows the method of finding the square root of a number, can find the value of $\sqrt{2}$ to as many digits as he wishes or desires The definite value of π cannot be found so easily Great mathematicians have made many attempts to do it

In ancient times Greek mathematicians presented the problem of transforming a circle, which is related to π into a square Its solution was found as late as the nineteenth century This is how they presented the problem " Only with the help of a foot-rule and a compass, a square of the area of a given circle should be drawn It should be noted that the foot-rule should be used for drawing lines only It should not be used for taking measurement and the compass should be used for only cutting the circle, its arc and lines "

In 1882 A D , Lindemann,the German mathematician showed that it was really impossible to find a solution to this problem [1] If this problem could be solved, $\sqrt{2}$ and π would be considered the irrational numbers of the same sort It should be noted here that a line of the definite length of $\sqrt{2}$ can be drawn with only a foot-rule and a compass But a line of the definite length of π cannot be drawn

With the help of the outer exterior polygon touching the circumference of

a circle at several points and the inner exterior polygon mutually joining several points on the circumference of the circle, Archimedes, the Greek mathematician went on increasing the sides of both the polygons to the largest possible number and tried to find the ratio between the diameter and circumference of a circle And he was very successful [2]

Since Archimedes tried to find the exact value of π, a large number of mathematicians in Europe have been trying to find the value of π They have given various formulae The German mathematician and philosopher, G Leibnitz, the Swiss mathematician L Euler, the British mathematicians, J Wallis and Lord Brounker are among them The formulae given by these four mathematicians are respectively as under[3]

(1) $$\frac{\pi}{2} = 1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \frac{1}{9} - \frac{1}{11} etc$$

(2) $$\frac{\pi^2}{6} = \frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} + \frac{1}{4^2} + \frac{1}{5^2} etc$$

(3) $$\frac{\pi}{4} = \frac{2}{1} \times \frac{2}{3} \times \frac{4}{3} \times \frac{4}{5} \times \frac{6}{5} \times \frac{6}{7} etc$$

(4) $$\frac{\pi}{4} = \cfrac{1}{1 + \cfrac{1^2}{2 + \cfrac{3^2}{3 + \cfrac{7^2}{9^2}}}}$$

$$etc$$

In all the above four methods, there are infinite components But we can make calculations only with a definite number of components In this calculation, therefore, the larger the number of components that we use, the truer is the value

During the last two or three centuries, there was a craze in Europe and other countries of the world to find a more and more exact value of π A mathematician named D Shanks found the value of π down to 700 digits subsequent to the decimal point But again the calculation was made on a modern electronic computer and many errors were found in it [4]

The needle problem which depended on the probability theory, was presented by the French scientist, Buffon On the basis of it, some scientists in Europe, tried, in the 19th century, to find the value of π and the results are as follows [5]

The scientist performing the experiment	Year	Number of needle interpolations	value of π
Wolf	1850	5000	3 1596
Smith	1855	3204	3 1553
Demorgan	1860	0600	3 137
Fox	1864	1030	3 1595
Lazzarini	1901	3408	3 141592

The values of π found now are as follows [6]

(1) 3 1415 92 65 35 89 79

(2) 3 1415 92 65 35 89 79 32 38 46 26 43 38 32 79

Mathematicians of ancient India also very well knew the value of π Āryabhaṭṭa very often used the equation[7] $\pi = 3\ 1416$

Scholars of the Jain tradition also have shown various values of π Though the word π (pi) is not found in Jain scriptures, following the calculations of area and circumference of circular objects, they used definite figures/numbers in place of π In some Jain scriptures,[8] the value of π is generally shown, in a very gross manner, to be 3 But where the circumference and area of a very large/vast circular area like Jambūdvīpa, are to be found, the formula $\pi = \sqrt{10}$ is used [9] Everywhere in ancient India, this value of π was accepted and it was a

little greater than the correct value of π (down to two numbers /figures, following the decimal point) In Jain scriptures we also find[10] $\pi = 16^2/9^2$ i e 256/81 There is not much difference between this value of π and $\sqrt{10}$ Moreover, showing the method of finding the circumference from the diameter of the circle, the Ācārya named Vīrasēna said that the circumference of the circle can be got by multiplying the diameter by 16 and dividing the product by 113 and adding to the result thrice the diameter The value of π thus[11] obtained is 355/113 It is a real surprise that it is entirely correct down to six digits subsequent to the decimal point It is very surprising that in the solution to the problem of squaring the circle, found by Śrīnivāsa Rāmānujan, an Indian mathematician this value of π is found If the area of a circle is 140,000 square miles,the length of a side of its related square is only one inch larger than its definite mathematical length [12] This value of π was familiar in China also Possibly, it went to China with the chinese travellers/visitors Hu-en-sang, Fahyan etc after the times of king Ashoka [13]

The Indian mathematician, Śrīnivāsa Rāmānujan has also given new formulae regarding the value of π[14]

(1) $$\pi = \frac{63}{25} \times \frac{17 + 15\sqrt{5}}{07 + 15\sqrt{5}}$$

(2) $$\pi = \sqrt[4]{9^2 + \frac{19^2}{22}} = 3\ 14\ 15\ 92\ 65\ 26\ 2$$

The first of these two values is true down to nine digits after the decimal point, whereas the second value is true down to eight digits after the decimal point

Recently, two years ago, a scientist has found on computer the definite value of π down to 170 hundred thousand digits after the decimal point [15] It is a matter of pride for India that formula of Śrīnivāsa Ramānujan, the famous mathematician of India, was used in this calculation

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ज एग जाणइ से सव्व जाणइ जे सव्व जाणइ स एग जाणइ

आचारागसूत्र

JĒ ĒGAM JĀNAI SĒ SAVVAM JĀNAI,
JĒ SAVVAM JĀNAI SĒ ĒGAM JĀNAI

"ONE, BY KNOWING WHICH ALL IS KNOWN,
ALL, BY KNOWING WHICH ONE IS KNOWN"

Ācārāngasūtra

12. Mathematical Form of Paramāṇu-units (Vargaṇā) According to Ācārāṅga sūtra

Varganā is nothing but a type of paramānu-units, possessing the same number of paramānus

The first Varganā means individual paramānus which have separate existence in the universe from each other A second Varganā means all paramānu-units throughout the universe which have only two paramānus In the same way, there are other Varganās possessing paramānu-units having 3, 4, 5, innumerable paramānus

*But these Varganās are not useful for Audārika bodies Even the paramānu-*units having infinite paramānus are not useful for Audārika bodies Suppose this infinite number is denoted as 'a_1' After these infinite numbers of Varganās, there are some useful Varganās possessing the paramānu-units having the number of paramānus a_1+1, a_1+2, a_1+3, $a_1+a'_1$ where $a_1 > a'_1$ but a'_1 is also infinite These Varganās are useful for Audārika bodies and they are also called Audārika Varganā

After $a_1+a'_1$ there are many unuseful Varganās, e g $a_1+a'_1+1$ $a_1+a'_1+2$, $a_1+a'_1+3$, $a_1+a'_1+a''_1$ Here $a''_1 > a_1+a'_1$ All these are not useful for Audārika bodies due to greater number of paramānus and also not useful for Vaikriya bodies due to greater size of paramānus

Now we assume that $a_1+a'_1+a''_1 = a_2$, then a_2+1 a_2+2, a_2+3, $a_2+a'_2$ Varganās are useful for Vaikriya bodies, where $a_2 > a'_2$ Varganās $a_2+a'_2+1$ $a_2+a'_2+2$, $a_2+a'_2+3$, $a_2+a'_2+a''_2$ are unuseful for Vaikriya bodies due to their greater number of paramānus and also unuseful for Āhāraka bodies due to their greater size of the paramānus Here also $a''_2 > a_1 + a'_1$

Now we will take $a_2+a'_2+a''_2 = a_3$ is unuseful Varganā for Vaikriya and Āhāraka bodies Then a_3+1, a_3+2, a_3+3, $a_3+a'_3$ are useful Varganās for Āhāraka bodies (here $a_3 > a'_3$) And $a_3+a'_3+1$, $a_3+a'_3+2$, $a_3+a'_3+3$, $a_3+a'_3+a''_3$ are unuseful for Āhāraka bodies due to their smaller size of paramānus and

also unuseful for Taijas bodies due to their greater size of paramānus Here also $a'_3 > a_1+a'_1$

Now we take $a_4 = a_3+a'_3+a''_3$ Therefore $a_4+1, a_4+2, a_4+3, \quad a_4+a'_4$ are useful paramānu-units for Taijas Varganā Here, $a_4 > a'_4$ $a_4+a'_4+1, a_4+a'_4+2, a_4+a'_4+3, \quad a_4+a_4'+a''_4$ are unuseful paramānu-units for Taijas bodies due to their smaller size and unuseful for Bhāsā Varganā for voice of living being due to their greater size of the paramānus Here $a''_4 > a_1 + a'_1$

We will take $a_4+a'_4+a''_4 = a_5$ So $a_5+1, a_5+2, a_5+3, \quad a_5+a'_5$ Varganās are useful for Bhāsā Varganā, i e voice of living animals, Here also $a_5 > a'_5$

Now $a_5+a'_5+1, a_5+a'_5+2, a_5+a'_5+3, \quad a_5+a'_5+a''_5$ are unuseful for Bhāsā Varganā due to their smaller size of paramānus and also unuseful for respiration of living bodies due to their greater size of the paramānus Here $a''_5 > a_1 + a'_1$ Now if we take $a_5+a'_5+a''_{v5} = a_6$, then, $a_6+1, a_6+2, a_6+3, \quad a_6+a'_6$ are useful paramānu-units for respiration of living organisms They are called Svāsōcchvāsa Varganā Here also $a_6 > a'_6$

Now $a_6+a'_6+1, a_6+a'_6+2, a_6+a'_6+3 \quad a_6+a'_6+a''_6$ are unuseful paramānu-units for respiration of living bodies and also unuseful for thinking or thoughts of animals having mind and five senses, men and divine beings and also hell beings Here $a''_6 > a_1+a'_1$

Suppose $a_6+a'_6+a''_{v6} = a_7$, then $a_7+1, a_7+2, a_7+3, \quad a_7+a''_7$ are useful paramānu-units for thinking of human beings divine beings, beings of hell and animals having mind and five senses They are called Manō -Varganā

Now $a_7+a'_7+1, a_7+a'_7+2, a_7+a'_7+3, \quad a_7+a'_7+a''_7$ are unuseful paramānu-units for Manō -Varganā (thoughts) due to their smaller size of paramānus and also unuseful for Kārmana Varganā due to their greater size of paramānus

If we take $a_7+a'_7+a''_7 = a_8$, then $a_8+1, a_8+2, a_8+3, \quad a_8+a'_8$ are useful paramānu-units for Kārmana Varganā which are completely used by every living being in a form of bondage of Karma and also using at a present moment

The Kārmana body (vital body) of every living being has been formed by these units of Kārmana Varganā and they are connected with soul upto liberation (mōksa) of living being This is a final type useful paramānu-units, i e Varganās Beyond these units, none is useful for living being though they

exists and they can be denoted as a_s+1, a_s+2, a_s+3, $a_s+a'_s+a''_s$ and so on

One thing is to note here that all 'a' mentioned above are type of paramānu-units having infinite numbers of paramānus, but they are not equal, and generally in all the series $a > a'$ and $a'' > a+a'$

(Arhat Vacana, Vol 8, No -2, April, 1996 39-40)

It is probably true, quite generally that in the history of human thinking the most fruitful developments frequently take place at those points where two different lines of thought meet These lines may have their roots in quite different parts of human culture, in different times or different cultural environments or different religious traditions hence if they actually meet, that is if they are at least so much related to each other that a real interaction can take place, then one may hope that new and interesting developments may follow

Werner Heisenberg

13. The Jambūdvīpa Laghusaṅgrahaṇī And The Modern Science

"Science is a series of approximations to truth, at no stage do we claim to have reached finality, any theory is liable to revision in the light of new facts This is both the joy and inspiration of science that there appears to be no end to new knowldge with its interest Each advance yields a more farreaching and intresting picture of the physical world while at the same time opening up fresh views in the shape of new problems awaiting solutions "[1]

– A W Barton

Man's curiosity is irrepressible It inspried man to make various new in-ventions and thus science came into existence This curiosity has been inhabiting the human mind since beginningless time Sometimes it becomes ardent and sometimes it becomes very mild But when it becomes ardent it makes efforts to find the secret of the order of the self-governed of the universe In order to get the secret generally two paths are adopted – the path of spirituality and the path of physics or science

Spirituality being at the basis of Indian civilisation, the ancient sages of all traditions adopted the subjective path of spirituality in order to know and understand the secrets of the universe In ancient time, the people of India were also very eager to know the secrets of the universe and they were in no way inferior to the people of any other civilisation Regarding this, the French researcher Mrs Collet Caillat says in the book, ' The Jain Cosmology '

'The civilisation of India, no less than other civilisations has not failed to ask questions about the place which man occupies in the world and the location of both the human and the animal kingdoms in space and time To these questions, for more than 3000 years the different religious circles and the principal schools of thought in India have striven unceasingly to supply answers " (P No 9)

Those who want to adopt the path of science, should have necessary qualifications for it Similarly, those who want to take the path of spirituality, should have certain physical, mental and intellectual merits If a man without these

merits, adopts the path of spirituality, he either totally fails or does not get expected success On the other hand, the path of science is also not so easy For knowing the secrets of nature, even the ultramodern instruments of science, prove to be very dwarfish

Though in the modern age of science, scientific instruments are available in plenty, they cannot stand in comparison with spiritual instruments But in the present time, it is very difficult to get spiritual merits and instruments So neither of the two paths, can be fully useful to us Therefore, there is only one way open to us for satisfying our curiosity We should study and present to other curious people of the world the secrets of nature that the ancient sages attained on the spiritual path and passed over to us

The Jambūdvīpa Laghusangrahaṇī gives the description of the earth i e Jambūdvīpa and the objects contained in it as presented by our ancient sages One sees a great difference between descriptions of objects found in these ancient books and the descriptions of objects found in books of modern science and astronomy It is very necessary to find out the real reason for this difference

Generally speaking, Jain Āgamas are the speeches of Śramaṇa Bhagavān Śrī Mahāvīrasvāmi, the sermons that he gave after attaining omniscience The eleven prime disciples, Ganadharas, put the sermons in the book-form There are 12 such sacred books which are referred as Dvādaśāṅgī In ancient time, the Dvādaśāṅgī was kept on the tip of tonge and every monk learnt it by heart The tradition of learning it by heart, continued nearly till the times of Śrutakēvalī Śrī Bhadrabāhusvāmī During twelve year famine in his times, some scriptural knowldge was forgotten by monks as a result of inadequate nutrition and weak memory After 980 years of nirvāna of Lord Mahāvīra i e about the year 510 of the Vikram era in the Vallabhī Conference (vācanā) Śrī Dēvarddhigani Kṣamāśramana Mahārāja got all Āgama scriptures put into written form much of the scriptural knowledge was forgotten and whatever was available contained some doubtful text Almost all the palm-leaf manuscripts of Āgama scriptures, which are available today, belong to the eleventh century of the Vikram era or a later time It means that not a single palm-leaf manuscript dictated by Śrī Dēvarddhigani Kṣamāśramana Mahārāja is available today During these 500 - 600 years, perhaps there have been many other changes in the texts of Āgamas and

the knowledge of Āgamas with variations in the text has come down to us On the basis of this knowledge of Āgamas, the later great Ācāryas wrote many treatises

This book entitled ' The Laghusangrahanī' or ' The Jambūdvīpa Sangrahanī' is probably a work of Yākinīmahattarāsūnu Bhagavān Śrī Haribhadrasūrijī Mahārāja [2] This book gives a brief description of Jambūdvīpa and the objects in it

The location of Jambūdvīpa

According to the tradition, the cosmos (Lōka) has three divisions the upper part called Urdhvalōka, the middle part called Tirchhālōka and the lower part called Adhōlōka The Urdhvalōka is also called Dēvalōka and Vaimānika gods- goddesses live there In the Adhōlōka there are seven hellish regions and hellish beings live there In a certain part of the first Ratnaprabhā hell, gods and goddesses of the type of Bhavanapati live In the middle 800 Yōjanas of the upper most 1000 Yōjanas, gods and goddesses of the Vyantara type live In the 80 Yōjanas of the upper most 100 Yōjanas, gods and goddesses of Vānavyantara type live [3]

In Tircchālōka there are innumerable islands and oceans In the centre of it there is Jambūdvīpa of circular shape [4] Its east-west and north-south length is 1,00,000 Yōjanas In the centre of it, there is Mt Mēru of the height of 1,00,000 Yōjanas and the expanse of 10,000 Yōjanas at bottom

To the south of Mt Mēru in Jambūdvīpa, there is Bharataksētra which is of the north-south expanse of 190th part of 1,00,000 Yōjanas i e 526 Yōjanas and 6 Kalā s and the east-west expanse of more than 14,471 Yōjanas To the north of it there is Mt Laghu-himavant with north-south expanse which is double that of Bharataksētra To the north of it, there is Himavantkṣētra with its double expanse To the north of it, there is Mt Mahāhimvanta with an expanse which double that of Himavantkṣētra To the north of it, there is Harivarsaksētra of its double expanse To the north of it, there is Mt Nisadha whose expanse is double that of Harivarsakṣētra To the north of it and in the centre of Jambūdvīpa, there is Mahāvidēhaksētra which has 64 times as much expanse as that of Bharataksētra Respectively to the north of Mahāvidēhakshtra, there are Mt Nīlavanta, Ramyakaksētra Mt Rukmi,

Hairanyavatksētra, Mt Śikharī and Airavataksētra of half the north-south expanse of each former mountain or ksētra

Mt Niṣadha and Mt Nīlavanta are of equal expanse and form Similarly, Mt Mahāhimavant and Mt Rukmi, Himavantksētra and Hairanyavatksētra, Mt Laghuhimavanta and Mt Śikharī, and Bharataksētra and Airavataksētra are mutually of equal expanse and form

Mahāvidēhaksētra which is at the middle of Jambūdvīpa is the most noteworthy Having an expanse of 33,680 Yōjanas and 4 Kalā s, it is 64 times as big as Bharataksētra There is Mt Mēru at the centre of it Uttarakuruksētra to the north of it and Dēvakuruksētra to the south of it are each of the shape of half-moon Their east-west length towards Mt Nīlavanta and Mt Nisadha, is 53,000 Yōjanas To the east and west of Uttarakuruksētra and Dēvakuruksētra, there are 16-16 Vijayas of Mahāvidēhaksētra The form of most of the objects there is similar to that of objects of Bharataksētra

Dēvakuru and Uttarakuru, Himavanta and Harivarsa and Ramyaka and Hairanyavat are called Yugalika ksētra, where men and women are born as twins Their detailed information is in the commentary on Jambūdvīpasangrahanī Similarly, the information of Mahāvidēha can also be seen in the commentary on Jambūdvīpasangrahanī the commentator states according to the Jain doctrine that the objects described in this book are mostly eternal The reason for this is that in Jambūdvīpa, non-eternal objects are infinite and it is not possible to describe them all Also, they undergo great changes under effect of time and place It is difficult to put all this in words Therefore, those objects are described in this book which are eternal and of a beginningless and endless state and which do not undergo any change under effect of time and place

There is Mt Vaitāḍhya of east-west length in the middle of Bharataksētra of the half-moon shape near Lavanasamudra to the south of Mt Mēru This mountain divides Bharataksētra in two parts, towards the Mt Mēru, is called the north-half of Bharata and the part towards Lavanasamudra is called the south-half of Bharata The rivers Gangā and Sindhu coming down from Padmasarōvara i e lake named Padma which is on the Mt Himavant, divides both these parts in three parts each Thus Bharatakṣētra is divided into six Khandas (sections) Every Cakravartī conquers all these six Khandas

(sections) The city of Ayodhya is at a distance of 113 Yōjanas and 3 Kalās to the south of Mt Vaitādhya in the middle Khanda of the south-half of Bharata Near the delta of the river Gaṅgā, there is a place called Tīrtha Māgadha Similarly, near the delta of the river Sindhu, there is a place called Prabhāṣā Tīrtha Between these two Tīrthas, there is a Tīrtha named Varadāma

To the farthest north of Mt Mēru, there is Airavataksētra which is similar in form to Bharatakṣētra In the place of Gangā and Sindhu rivers, there are two chief rivers named Raktā and Raktavatī This is a very brief discription of Jambūdvīpa

It is natural that on reading this discription, not a single man of today will be able to accept it Today man has plenty of scientific instruments and he believes that with these instruments he can do what he wishes to do Modern science has very big telescopes and observatories It has many kilometres vast radio-telescopes, too With these radio-telescopes, he can see and know what happens in any corner of the universe, can directly or indirectly visit the planets - the moon, the mars, the jupiter, the saturn etc , and can show its wonderful sights on the television

The difficulty is that with the help of these instruments, we see the sky but we do not see other parts of Jambūdvīpa or some strong obstacle stop the working of the instruments But all these are matters of astronomy As far as the earth is concerned, scientists accept only the present world, the world that we can see, know and visit with aeroplanes etc and shows that the earth is round like a ball but the possibility that there is living world in other places (planets) inhabited by more intelligent human beings, cannot be ruled out According to them there are many other suns like the sun in our solar system There are other solar systems including planets and the earth among them, are inhabited by human beings

The Jain philosophy also accepts the existence of many suns with their own groups of planets According to the Jain philosophical belief with every sun and moon have 88-88 planets and 66975×10^{14} stars

But researches made till now do not support this and researches that are made, are only theoretical and rely on some inferences of the past On the basis of the descriptions given in Jain scriptures, some practical research work needs to be done

Now almost all accept that the Jain philosophy is very ancient Many people believe that the doctrines given in the ancient treatises of Jain philosophy are systematic, well-arranged and logical Regarding this Śrī Nemichandji Jain, the editor of 'Tīrthankara ' writes

" The philosophical aspect of Jain philosophy is logical and no one can refute it and there is no question about it but when it comes to geography, astronomy and food restrictions, many questions arose because these are the subjects that suffered discents from time to time "[5]

It is, therefore, necessary to discuss these subjects properly in the context of today Is the present visible earth really round like a ball? Does it really move? These two questions against the Jain geography are really important According to the Jain doctrine, the earth is motionless and the Sun the moon, planets, constellations, stars etc move in space around Mt Mēru in a round strip at the height of 790 to 900 Yōjanas from the level surface of the earth Jain scriptures show very minute calculations of motion and change of place of the Sun and the moon The tradition of making paintings, showing the real nature of the objects of geography and astronomy in Jain manuscripts is at least a thousand years old and it prevails even today[6]

When science had not at all developed in the west and when Western civilisation had no knowledge of astronomy Jainācāryas had given minute and detailed information about astronomy and geography in Indian civilization and especially in Jain philosophical tradition The later Jainācāryas have collected the information in some treatises and their commentaries

But along with the description of eternal objects of Jambūdvīpa, they have not given even the slighest description of the earth of their times, its shape etc Nothing is, therefore, known about opinions and beliefs of the common man of those days, regarding the shape of the earth On the other hand, geography and astronomy have so much developed today that with various instruments they have shown its shape and located the place of the earth in the solar system On the one hand, ancient Jainācāryas are completely silent on this point and on the other hand, the present day Jain scholars or Jainācāryas cannot give correct information about the real shape of the earth and its location One finds no reference to it in Jain literature

available today According to those books, Bharataksētra has the length of more than 14471 Yōjanas and width of 526 Yōjanas and 6 Kalā s The present-day Bhārata i e India, cannot be said Bharataksētra The description of Bharatakṣētra given in Jain scriptures does not at all coincide with the present-day situation of Bhārata That is why present-day Jain scholars and Ācāryas believe that the earth of today is a portion of middle section (khaṇḍa) of the southern part of Bharatakṣētra

Rev Pannyāsa Śrī Abhayasāgarajī has made tremendous efforts to show that the earth is not round

1 In order to prove that the earth is round, present-day scientists give the example of boat, sailing on the sea They say that as the boat, ship or steamer goes farther, its bottom, then the upper part and the top part disappears because roundness of the earth obstructs But this is not true As the steamer goes farther, it looks smaller But one can see it and see it as a whole If not the whole steamer but its upper part is seen with the nacked eyes on account of Earth's roundness, it would not be possible to see the whole steamer through a telescope But practically, when the steamer goes out of the nacked eyesight, the whole steamer can be seen with the help of a *telescope*

Really speaking, the structure of our eye is such that as the object goes farther, its image on the retina becomes smaller and when the object goes extremely far away, its image on the retina becomes so small that optical nerves cannot grasp it This also happens to aeroplanes etc flying high in the sky These facts prove that the earth is not round

2 In America, the light-house of Heterash is seen from a distance of 40 miles What is the reason? If the earth is round, the curve of the earth at forty miles, would be 900 feet but the light-house is only 300 feet high

3 The Suez canal is built on the principle that the earth is not round and it was built by French engineers This is mentioned in the law of British parliament

4 In 1838 Captain J Ras went on a voyage with Captain Freshier towards the south pole They sailed in a ship as far as it was possible Then they came across a strong snow-wall which was 450 to 1000 feet high On it they walked continuously for four years and travelled a distance of 40,000

miles but did not reach the end of the snow-carpet

The circumference of the earth at the degree of latitude of the place where the snow-carpet was found is only 10,700 miles If the earth is round, they would have come to the place four times But instead of that, they had to come back and they took two and half years to come back This fact also proves that the earth is not round

5 The distance between two longitudes changes with the latitude As we go northward or southward from equator, the distance between two longitudes decreases The distance between two longitudes in the north at 23 5 latitudes is 40 miles If the earth were round like a ball, the distance between two longitudes at 23 5 latitudes even in the south would be 40 miles, that distance is found to be 25 miles, and south below, the distance increases instead of decreasing and at some place the distance is found to be of 103 miles If this is so, how can the principle that the earth is round like a ball stand?

6 According to the scientific belief the earth moves round the Sun with its axis bent at 23 5° Its north pole is, therefore, always infront of the pole star The pole star appears in the middle of the sky over the head of man on the north pole and man on the equator see the pole star on the horizon The pole star can never be seen to the south of the equator But Captain Mill saw the pole star to 30° latitude in the south What can be the reason for it?

7 The longest day on Shetland Island on 70° latitude in southern hemisphere is only of 16 hours and 53 minutes But the longest day in Norway on 70° latitude in the north is of three months If the earth is round like a ball how can this happen? [7]

All these evidences only prove that the earth is not round like a ball But what is the shape of the present day earth? It cannot be known In order to prove that the earth is not round, the arguments of scientists have been refuted Similarly in order to prove that the earth does not move or rotate Rev Śrī Abhayasāgarajī and other researchers also have adopted negative approach They should adopt a constructive approach, strengthen the faith of people and make experiments according to the principles shown in Jain scriptures As long as we do not give practical proofs, nobody will accept what we say

Concept of Time

On one hand, there is a great difference between principles of Jain geography and astronomy and those of the modern geography and astronomy and many questions have been raised against Jain scriptures but on the other hand, the principles mentioned by Jain scripturists in the field of physics, have proved to be entirely true There is a wonderful similarity between the principles regarding time, space and matter given in Jain scriptures and the principles of modern science

Ancient great sages and modern great scientists have given serious and elaborate thought to the concept of time In Jain philosophy, much has been written about time, space and pudgala (matter) Similarly, in modern physics western scientists have written a lot and even today new researches as being made We shall compare here the beliefs accepted in the Jain philosophcal tradition and in modern physics

The relativity of time according Jain scriptures, shown by Śrī Vijaya Udayasūrijī while commenting on the word समयखित्तंमि 'samayakhittammi ' in the verse ' savvē vi pavvayavarā सव्वे वि पव्वयवरा ' (verse No 29) of 'Jambūdvīpasangrahanī ' sūtra and the relativity of time shown by Einstein, the great scientist of the present century, have a wonderful similarity

The Jain philosophy shows two types of time (1) relative time and (2) absolute time

Einstein says that time-practical time i e relative time, day and night etc are only on the earth because day and night are caused by daily motion of the earth i e rotation of the earth on its axis Jain scripturists say that day and night are only in the two and a half islands (samayaksētra) where the sun, the moon, planets constellations, stars etc move around Mt Mēru Such divisions of time as day and night are caused only by rotation of the sun and the moon *

Einstein says that there is nothing like day and night in space Jain scriptures say that outside the two and a half continents where the sun, the moon etc are motionless, there is nothing like day and night

Still however, the life-span of living beings outside the two and a half continents and of the celestial and hellish beings is calculated according to

day and night of the two and a half continents Similarly, 80 or 82 days are discounted from the life-span of an astronaut who lives in space for 80 or 82 days But it is said that there has no experience of day and night

The Nyāya and Vaiśēsika systems of thought also accept Kāla (time) as a separable material cause They also believe that time is a substance

Is time substance or not ? On this point, too, there is a difference of opinions among Jain philosophers Referring to this, the author of the Tattvārtha Sūtra states कालश्चेत्येके ।। kālaścētyēkē (Sūtra 38 Cha 5) i e Some Ācāryas believe that time is also a substance The scriptures of the Digambar tradition attach a special importance to the five substances 1 Jīva (soul) 2 dharma (medium for motion) 3 adharma (medium for rest) 4 space and 5 matter But Ācārya Nemicandra, the Digambar Jain philosopher, says in the following gāthā i e verse of his ' Dravyasangraha ' that time has as many particles i e paramānus (atoms) as the cosmic space has pradēśas (space-points) -

लोयायासपदेसे इक्किक्के जे ठिया हु इक्किक्का । रयणाण रासी इव ते कालाणू असखदव्वाणि ।।

lōyāyāsapadēsē ikkikkē jē thiyā hu ikkikkā
rayanānam rāsī iva tē kālānū asankhadavvāni

From the view points of vartnā, (perduration), parināma (transformation), kriyāparatva (activity), aparatva (non-activity), the real time i e time is absolute and it is acceptable to Niścayanaya (the definitive stand-point) But as long as space is considered from the practical view point, the time is relative Digambar Jain scriptures show that space and time are co-related with each other Similarly, the modern physics also accepts that time is in every space point To the three dimensional world, Einstein adds the fourth dimension called time-space continuum

Jain scriptures believe that time, the non-spatial continuum pervades the whole cosmos (Lōka) because it is related to verious transformations of substances and the living element (soul) and the element pudgala i e matter pervade the whole cosmos, all the fourteen Rājalōka Einstein explains this with time-space continuum A simple illustration can be given as under

Suppose there are three points A, B and C in a straight line in space at a distance of 30 lakh kilometres from one another

•<=====30 lakh kms =====>•<=====30 lakh kms ======> •

A B C

Suppose there is flash of light on point A This flash of light will be seen on point B after 10 seconds Then for point A, the place of its origin, at that time the flash of light will be a matter of the past and for point C, it will be a matter of the future Thus time is a distance between space points It is, therefore, necessary to mention with all that happens in space, the time of its happening As the time-space continuum is important in the modern physics, so it is regarded as very important in ancient Jain scriptures The real time can be divided into (1) the relative and (2) the non-relative and this can be included in the relative real time

On studying the following citations* of modern science regarding time, one can see that there is a great similarity between concepts of science regarding time and Jain philosophical beliefs

1 The speed of space-point relative to its surrounding points is the fundamental aspect incorporated in the design of the universal space and from *this basic phenomenon of " changing positions or space-point " arises the* very " concept of time "

2 Since the dynamic state of space is eternal, time, too, is basically eternal

3 Since all the material phernomena originate from space, the time related with changes in our material environment is also a product from the primary time inherent in the dynamic substratum of space Time is real since space and its motion are real Time is absolute since space is absolute

All these three citations reflect the definition of real time of Jain philosophy

4 The ' time ' of our day-to-day experience emerges from the changes in the position of material bodies and also changes in their structure due to the inevitable field interactions causing assembly, decay and disintigration

According to Jain philosophy, space is a single indivisible and inactive substance but pudgala i e matter is active or mobile and pervades the whole cosmos Therefore, if the word ' space ' is replaced by ' pudgala ' i e matter

in the above mentioned scientific concepts, all these concepts will be acceptable to Jain philosophy

Thus the present-day scientific researches regarding time largely substantiate the concept of Jain philosophy

Mathematics in Laghusangrahaṇīsūtra

Jambūdvīpasangrahanīsūtra does not make any special use of mathematics It only shows how to find the circumference and area of Jambūdvīpa which has a diameter of 1,00,000 Yōjanas

The circumference of Jambūdvīpa can be obtained by multiplying the square of its diameter by 10 and the finding square-root of the result It can be shown in a formula as under

Circumference = $\sqrt{10}$ (diameter) ^{2} I

The modern mathematics uses the following formula to find the circumference of a circle

Circumference = 2π radius II

Comparing formulae (I) and (II) we get $\pi = \sqrt{10}$ i e

$\pi = 3\ 1622776$ approximately

The area of Jambūdvīpa can be obtained by multiplying the circumference of Jambūdvīpa by one forth of its diameter i e one half of its radius It can be shown in a formula as under

$$\text{Area of a circle} = circumference \frac{diameter}{4}$$

$$= \sqrt{10(diameter)}\ ^2 \times \frac{diameter}{4}$$

$$= \sqrt{10}\ \frac{diameter \bullet diameter}{4}$$

$$= \sqrt{10}\ \frac{2radius \bullet 2radius}{4}$$

$$= \sqrt{10}\ \text{radius}^2$$

The modern geometry also uses the following formula to find the area of a circle

Area of a circle = π (radius)^2 Here also $\pi = \sqrt{10}$

Almost everywhere in śvētāmbara tradition $\pi = \sqrt{10}$ But various values of π are found in Digambar tradition In the Trilōkasāra [10] $\pi = 16^2/9^2$ i e 256 / 81

Here π = 3 1604938271 The Trilōkasāra also shows 3 and $\sqrt{10}$ to be the value of π but they are very gross [11] Moreover, Ācārya Vīrasēna shows quite a different value of π Showing the method of finding the circumference of a circle, he says, " Multiply the diameter by three and then add to it what you get by dividing by 113 the diameter multiplied by 16 You will then get the circumference of the circle It can be shown in a formula as under

Circumference = 3 (diameter) + 16(diameter) /113

By simplification, we get circumference =355/113 diameter

Comparing this formula with the well-known formula of today i e circumference = 2 π radius, we get[12] π = 355/113 Here π = 3 1415929

This value of π was well-known in China also Possibly, they took the value of π from Indian tradition Perhaps, Buddhist monks who went to China from India made it popular [13]

In short, four different values of π are found in the ancient Jain tradition

π = 3 I

$\pi = \sqrt{10}$ = 3 1622776 II

π = 256 / 81 = 3 1604938271 III

π = 355 / 113 = 3 1415929 IV

The first of these values is very gross and it is not accepted now-a-days This value is shown in the book the Trilōkasāra The second value is also found in the Trilōkasāra It is accepted everywhere in śvētāmbara tradition also The third value is also shown in the Trilōkasāra But the fourth value is shown by Śrī Vīrasēnācārya

According to modern mathematics π = 3 141592653 This shows that the value of π shown by Vīrasēnācārya is true upto six digits after the decimal point

There is no special reason why, in the Jain tradition, there are different values of π and different methods of finding the circumference and the area of a circle

Really speaking, the Jain philosophy is spiritualistic and its ultimate aim is salvation In Jain scriptures we find the description of the form, shape etc of the cosmos (Lōka) because they help in spiritual development The form of Lōka, i e universe, the form of the hell, the form of gods, the human world - the two and a half islands (dvīpas) - the Jambūdvīpa etc are shown in order to enable us to know where and in what condition our soul is at present, in what condition it was in the past, and what condition it can have in the future

It is not inconsistent to believe that since the common people had no other use of this knowledge that at different times, with different sorts of people in view, these different methods were used in order to impart this knowledge to common people in simple way This is why one finds different values of π in various Jain scriptures which are available today

Ācārya Śrī Vīrasēna shows that π = 355 / 113 The Indian mathematician Śrī Ramanujan shows this value of π in a different way He solved the problem of squaring the circle, the problem suggested by Greek mathematicians As a result he got 355/113 as a value of π

This article is accompanied by a brief article on various values of π On reading it, one can pretty well understand the perplexity of π

Jain Time-cycle and Cosmic Calendar

In the commentry on Laghusangrahanīsūtra, Ācārya Śrī has given a detailed discription of the seven ksētras (regions) such as Bharata etc as well as the time-cycle constituted 12 ārās exprienced in Bharata-ksētra and Airavata-ksētra It is possible that some may doubt whether the time-cycle is real We shall, therefore here think of it from the view-point of modern science Let us first understand the divisions (ārās) of the time-cycle

The time-cycle has two chief divisions--Utsarpinīkāla and Avasarpinīkāla

In Utsarpinīkāla the height, life-span, physical capacities etc of human beings and animals develop, spiritual blemishes (kasāyas) such as attachment, aversion, anger etc diminish and inauspicious tendencies also diminish gradually Thus, few spiritual blemishes of men and women, birds and beasts, rise

In Avasarpinīkāla, the development is contrary to this In the beginning, the height, life-span etc of human beings and beasts etc are the utmost But as time passes, they diminish In the beginning inauspicious tendencies, jealousy, illusion, attach, aversion, anger etc of human beings are very slight but then as time passes, they increase

Both Utsarpinīkāla and Avasarpinīkāla have six ārās (spokes of the wheel of time) each Twenty-four Tīrthankaras are born in each half of the time-cycle The joint duration of both is 20 kōdākōdī i e $20X10^{14}$ Sāgarōpamas (10 kōdākōdī Sāgarōpamas of Utsarpinīkāla and 10 kōdākōḍī Sāgarōpamas of Avasarpinīkāla) The present time belongs to Avasarpinīkāla So, we shall first think of it Utsarpinīkāla is contrastive to it

The first ārā (spoke of the wheel of time) in Avasarpinīkāla is of duration of four kōdākōḍī Sāgarōpamas, the second ārā is of three kōdākōdī Sāgarōpamas, the third ārā is of two kōdākōḍī Sāgarōpamas, the fourth ārā is of one kōḍākōdī Sāgarōpamas less by 42000 years and the fifth and the sixth ārās of 21,000 years each By the end of the third ārā, the first Tīrthankara is born The fourth ārā begins shortly after nirvāna of the first Tīrthankara The rest twenty-three Tīrthankaras of this group of twenty-four Tīrthankaras are born in this fourth ārā Shortly after nirvāna of the twenty-fourth Tīrthankara, the fourth ārā comes to an end

According to Jain scriptures, human beings and birds and beasts in the beginning of the first ārā, are yugalik or twins and they have a hight of 3 Gāus and a life-span three palyōpamas [14] Height, life-span of living beings gradually decrease and in the beginning of the second ārā, their height is of two Gāus and life-span is of two palyōpamas In the beginning of the third ārā, the decreasing height and life-span of twin human beings and beasts etc are one Gāu and one palyōpamas respectively At the end of the third ārā, the life-span of the human beings is of 84 hundred thousand pūrva years [15] and their height of 500 Dhanusyas Half-way in the fourth ārā, man

has a height of 450 Dhanusyas and a life-span of nearly 72 hundred thousand pūrvas In the beginning of the fifth ārā, their height is of 7 hands and their life-span is of 72 years approximately At the end of the fifth ārā, his height is of only one hand and its life-span is only of 20 years As time passes, life-span and height go on decreasing, though not in a specific ratio It is definite that as time passes in Avasarpinīkāla, the rate of reduction in life-span and height, is higher and higher

A well known scientist Mr Carl Segan has made a cosmic calendar It gives dates of cosmic incidents The chart given in Darwin's world-famous book, ' Origin Of Species ' also gives dates of cosmic events Leave alone the names of the events, the ratio of time intervals between the events shown in them is very similar to time intervals between the incidents in Avasarpinīkāla of the time-cycle shown in Jain scriptures

The scientists of today may think that there is an exaggeration about the life-span and height etc of the first Tīrthankara Śrī Rsabhadēva But if the Jain time-cycle and the cosmic calendar are minutely studied, it does not at all seem to be improbable or impossible Among the fossilized ruins of giant animals found now-a-days on the earth, the fossilized ruins of the dinosaur are chief The ruins show that the dinosaur was 150 feet long and according to the chart of Darwin, it belonged to the masozoic period This time is believed to be earlier than nearly seventy million years

According to the Jain time-cycle, this time was later than that of Srī Vāsupūjyasvāmi, the twelfth Tīrthankara and earlier than that of Srī Śāntinātha, the sixteenth Tīrthankara A comparison with the ratio of time duration according to the cosmic calendar shows nearly the same Someone may raise the question that the calculation of scientists of today shows that this was the time prior to only seventy million years while according to Jain time-cycle this was the time prior to the time between forty-seven Sāgarōpamas and three and a half Sāgarōpamas According to Jain calculation of time ten kōdākōḍī palyōpamas make one Sāgarōpama and one palyōpama contains innumerable years What accounts for this great difference?

In order to determine the date of fossils, scientists use isotopes of carbon-14 and determine their ancientness i e date of its existence on the basis of the ratio of radiation of radio-active rays emerging from the fossils

But scientists themselves have admitted that this method is faulty and leads to a difference, not of hundreds or thousands of years but of millions of years Therefore, an object which is 70 or 80 million years old according their calculation, may be a thousand million years old or perhaps still older The principle of the method adopted by scientists being faulty, their calculations are not true and their conclusions are only inferential and, therefore, they are not at all reliable

Regarding this, Max Toth and Greg Nielsen, the authors of the book ' Pyramid Power ' write

" It should be noted here that to determine the date of an archaeological find, excavators all over the world have been using the analysis of radio-active carbon, the isotope C-14

Unfortunately it now appears that the dates obtained through the use of this method are highly questionable, since contamination from present-day organic materials could substantially affect the process Archaeologists now believe that most of the sites dated with carbon 14 are older than the dating process showed that they were There is currently an enormous controversy ranging in archaeological circles over the claim of some archaeologists that carbon-14 dating is incorrect by thousands of years, not hundreds as was previously thought " (Pp 20)

Regarding this Dr Narendra Bhandari (Chairman, Solar system, Space unit, PRL, Ahmadabad) mentions that Carbon-14 method works only for a period below 50,000 years For older fossils other methods are used According to his opinion, Carbon-14 dating process is useful only for the fossils that possess carbon

The present day scientists fear that if the developed and developing countries make excessive use of the space shuttles to launch satellites in space often and to make experiments in space, the ozone layer of atmosphere which stands against the ultraviolet rays of the sun which are harmful to human beings and the living world, will be used up and ultraviolet rays of the sun will destroy the living world The sun will pour fire and the earth will be utterly destroyed

The description of the sixth ārā in Jain scriptures is similar They state that there will be a very poisonous rain of fire, salt etc and there will be a

widespread lamenation Thus the earth will be utterly destroyed During the day-time human beings etc will live in caves of Mt Vaitādhya They will come out only at night All will be non-vegetarian

In short, the fear of scientists is true Lord Mahāvīra forecast it more than 2500 years ago

Thus the ruins which are the evidences of Darwin's theory of evolution can serve as evidences of Avasarpinīkāla of the Jain religion What is needed is more research work in the field

According to Jambūdvīpasangrahanīsūtra, it is a universal truth that the earth is neither round nor mobile nor it rotates We shall have to prove it with scientific experiments If the earth were perfectly round like ball, the perfectly north-south circumambulation around it would be possible like the east-west circumambulation As an aeroplane can fly over the north pole, it should be able to fly over the south pole But Trans World Airlines and Pan-American Airways have informed on inquiry that no such air-flight is available

Information about the orbit of satellites and of satellites of fully north-south orbit, was sought *from the* ISRO, *the famous space-science institution* of India and from the observatory There is no reply from the ISRO at that time Now, it is available We, therfore, to think of it The reply from the observatory contained information irrelavant to the answer

In conclusion, if anything discordant with scriptures is written in the preface to this book, written with a broad scientific out look, I pray forgiveness I stop here

[Adopted from the *preface to the book Jambūdvīpasangrahanīsūtra*]

References

1 A W Barton [Introduction Cosmology Old And New by G R Jain]

2 Though it is diffcult to say whether this work is of Yākinīmahattarāsūnu Ācārya Haribhadrasūriji Mahārāja or some other Ācārya named Śrī Haribhadrasūriji this statement is made according to the current tradition and the statement of Rev Ācārya Sri Vijaya Udayasūriji, the author of the commentry But it is stated on page No 50 in the book ' Śri Haribhadrasūriji ' written by Prof Hiralal Rasikdas Kapadia and published in Sayaji Granthamala -- " The name of Yākinīmahattarāsūnu Sri Haribhadrasūriji as the author of

Jambūdvīpasangrahanī, is mentioned by Peterson, M K Mehta, M N Doshi, Pandit Hargovindadas, Pannyas Kalyanavijay, Pandit Bechardas Doshi etc , but on the page No 48 of the same book, the list of works of Śrī Haribhadrasūriji Mahārāja is given according to bruhadvrtti i e sanskrit commentary written in Vikram era 1295 by Śrī Sumatigani on verse No 55 of Ganaharasaddhasayaga i e Ganadharasārddhaśataka, it includes ' sangrahaniivrtti ' but not 'Jambūdvipasangrahani ' It is not clear which 'sangrahani' is meant by the word 'sangrahani' in 'sangrahanīvrtti' In short, no strong ancient evidence is available to show that Yākinimahattarāsūnu Haribhadrasūriji is the author of this Laghusangrahani (Jambūdvipasangrahanī)

3 People of today may find these statements about god to be untrue The E S P researchers find during experiements that some people describe their past birth And their description is fully in full agreement with the description given in Jain scriptures Please see ' Science Discover Eternal Wisdom ' by Muni Śrī Amarendravijayji Mahārāja

4 जम्बूद्वीपलवणादय शुभनामानो द्वीपसमुद्रा ।।७।।द्विर्द्विर्विष्कम्भा पूर्वपूर्वपरिक्षेपिणो वलयाकृतय ।।८।।
jambūdvīpalavanādayah śubhanāmānō dvipasamudrāh 7 dvirdvirviskambhāh pūrvapūrvapariksēpinō valayākrtayah 8 (Tattvārtha Sūtraa, Adhyay 2)

5 Tirthankara (A Hindi magazine) May, 1987 P No 5

6 Jain cosmology has inspired many descriptions of this kind There is also a tradition of manuscript illustration more than 1000 years old, which despite its age remains amazingly fresh (Jain Cosmology-cover page - 2)

7 '1-2 3-4-5 6 7 ' The Tattvajñāna Smārikā, Part IV, P 27 by Ashish Manekalal Shah

8 तन्मध्ये मेरुर्नाभिवृत्तो योजनशतसहस्रविष्कम्भो जम्बूद्वीप ।।९।। सूर्याश्चन्द्रमसो ग्रहनक्षत्रप्रकीर्णतारकश्च ।।१३।। मेरुप्रदक्षिणागतयो नृलोके ।।१४।। तत्कृत कालविभाग ।।१५।।

tanmadhyē mērurnābhivrttō yōjanaśatasahasraviskambhō jambūdvīpah 9 sūryāscandramasō grahanaksatraprakīrnatārakaśca 13 mērupradaksināgatayō nrlōkē 14 tatkrtah kālavibhāgah 15

(Tattvārtha Sūtra, Adhyay-4, sūtra No 13,14 15)

9 1-2 3-4 BEYOND MATTER by Paramahansa Tewari P 87-88

10 r = 9/16 (side of square equal area) or p = $(16/9)^2$ (V 18)

[Basic Mathematics by Prof L C Jain P 47]

11 1 p (gross) = 3d (V 311) 2, p(subtle) = $\sqrt{10}$ d (V- 311)

[Ibid P 47]

12 Ibid P 33

13 Ibid P 33

14 In a palyōpama, there are innumerable years

15 A pūrva year consist of 70,56,000,00,00,000 years

WHAT IS SOUNDLESS, TOUCHLESS, FORMLESS, IMPERISHABLE,
LIKEWISE TASTELESS, CONSTANT, ODOURLESS,
WITHOUT BEGINNING, WITHOUT END, HIGHER THAN THE GREAT,
STABLE —
BY DISCERNING THAT, ONE IS LIBERATED FROM THE MOUTH OF
DEATH KATHOPNISHAD – 3 15

KNOWLEDGE, WHICH COMES FROM SUCH AN EXPERIENCE, IS
CALLED 'ABSOLUTE KNOWLEDGE'

14. The Jain Time-Cycle And The Cosmic Calendar

Since the development of his thinking faculty, man has been tirelessly trying to find solutions to the questions of the form and origin of the universe Whether the attempts are spiritual or scientific, everyone ultimately wants to know the laws and secrets that governs the universe It is difficult to know the secrets with scientific methods The great sages of the past, have known them with spiritual methods and have put them before us But under the influence of the present times and the western civilization, we hesitate to believe as to be true *The absolute truth is out of bounds of time and space Time does not* make even a scratch on it, let alone a deep mark On the contrary, backed in the oven of time absolute truth becomes very ripe Such are the doctrines of Jainism, ripened by being backed in the oven of time They have passed through various tests

Since the origin of the branch of atomic physics and the branches establishing relations of time, space, matter and its energy among various branches of science and since decades prior to it, the question of origin and destruction of the universe and mass-accumulation of the universe has always been confusing and various theories have been put forth for them Of all these theories, the Big Bang Theory has got the greatest acceptance Though the Jain religion partially believes in the Big-Bang theory, it does not believe in the presentation that scientists make of it

There is a great similarity between the duration of time of the origin of the sun, of the earth, of the living world, of human beings etc following Big-Bang, as described by Carl Segan according to the belief of scientists and the time-cycle mentioned in Jain scriptures Though the durations are almost equal, the differences of incidents and circumstances are great According to the Jain doctrine the sun, the earth, the living world or living beings and the human-world or beings are not originated from nothing i e they are not newly created

But the modern science believes that they are born a new and in the evolution of the universe, first unicellular micro-organisms then multicellular organisms and gradually other higher insects, the monkey and then the man was evolved This is completely an illusion and untrue

First of all, let us see the cosmic calendar of Carl Segan Mr Carl Segan divided the time between Big-Bang and the moment of destruction of the whole universe (pralayakāla) into 12 months and 365 days The Big Bang occurred on the first day of January and Carl Segan gives as under the account of incidents that followed

1 The Big-Bang - January,1
2 The formation of the milky way - May, 1
3 The creation of the Sun - September 9
4 The creation of the earth - September, 14
5 The beginning of life on the earth - September, 25
6 The oldest rock formed on the earth - October, 2
7 Fossils formed - October 9
8 Formation of sex organs of generation among micro-organisms -November, 1
9 Development of living cells - November, 15
10 Oxygen in atmosphere on the earth - December, 1
11 Ditches at high temperature on the Mars were formed - December 5
12 Insects were born - December, 16
13 Fishes were born - December, 19
14 Birds were born - December, 27
15 Gigantic mammals were born - December, 30
16 Man was born - December 31

Now follows the interesting account After man was born on December 31 the time of incidents is shown in hours, minutes and seconds as under -

17 Man was born at 10 30 p m
18 Stone instruments and weapons began to be used at 11 00 p m
19 Farming invention at 11 hours, 50 minutes and 20 seconds
20 Buddha was born at night at 11 59 55
21 Jesus was born at night at 11 59 56
22 Invention of Zero in India at 11 59 57

23 The renaissance in Europe and the experimental method in science, originated at night at 11 59 59

24 The progress of technology, the invention of weapons to kill mankind, the beginning of the universal civilization and the beginning of space flight - now and at the first second of the new year

This is the ultra-modern cosmic calendar, made by Dr Carl Segan, the top-rank scientist of the world and approved by other high rank scientists

According to the chart given in the book 'Origin Of Species' written by Charles Darwin and published recently in 1979 A D 'cosmological' incidents can be shown as under

1 Nearly 5 thousands million years ago - The Big-Bang and separation of the earth

2 Nearly 4 6 thousand million years ago - The crust of the earth was formed

3 Nearly 3 5 thousand million years ago - Life began and bacteria were produced

4 Nearly 1 7 thousand million years ago - Oxygen was produced in the atmosphere

5 Nearly 70 crore years ago - Production of multicellular living beings, earth-worms and their fossils

6 Nearly 57 crore years ago - Production of fossils of many kinds of invertebrate animals for the first time

7 Nearly 52 5 crore years ago - Production of fishes

8 Nearly 38 crore years ago - Production of insects

9 Nearly 36 crore years ago - Production of frogs etc i e amphibians i e animals moving on earth and in water

10 Nearly 28 crore years ago - Production of reptiles etc i e snakes etc

11 Nearly 22 crore years ago - High level and final-stage development of reptiles and production of dinosaurs

12 Nearly 21 crore years ago - Production of mammals

13 Nearly 13 crore years ago - Control of dinosaurs i e Dinosaurs as a dominant and prominent animal

14 Nearly 7 crore years ago - Utter destruction of dinosaurs

15 Nearly 5 crore years ago - Development of mammals

16 Nearly 1 crore years ago - Production of hominids for the first time

Such durations of time as are mentioned above are shown in Jain

cosmology These are described in ancient Āgamas i e Jain canonical scriptures and other treatises They are as under

According to Jain doctrine the time-cycle has two main divisions called Utsarpinīkāla and Avasarpinīkāla in Jain-terminology The Avasarpinīkāla is the time of our modern cosmic calendar The Avasarpinīkāla has six sub-divisions called ārās, spokes of the wheel of time i e era or epoch According to Kalpasūtra, a Jain canonical scripture, the first spoke (ārā) is called suṣama-suṣama and its duration is of four kōdākōdī (4 x 10,00,00,00 x 10,00,00,00) i e 4×10^{14} Sāgarōpamas (ocean-measured periods of time) One Sāgarōpama is equal to 10^{15} palyōpamas (glass measured periods of time) In short the duration of time of the first suṣama-susama ārā is equal to 4×10^{29} palyōpama years *Palyōpama is the smallest of the big units of time The number of years* in a palyōpama is certain but not clearly expressed and cannot be shown in figures Even Āgamas and other scriptures say that a palyōpama has innumerable years This is, therefore, a matter for further research The second ārā (Spoke of time-wheel) is called susama Its duration is of 3×10^{29} palyōpamas The third ārā is called susama-duhsama and it has 2×10^{29} palyōpama years The fourth ārā is duhsama-susama It has a duration of 42000 years less 1×10^{29} palyōpama years The fifth ārā is called duhsama It has only 21000 years The sixth ārā is called duhsama-duhsama It also has 21000 years Thus, the total duration of Avasarpinīkāla is of 10^{30} palyōpama years

Reverse is the order of Utsarpinīkāla Both together make time-cycle of 2×10^{30} palyōpama years

Non-Jain books of Indian culture also give a similar description of time The Manusmrti and its commentators divide the life-time of the cosmos i e universe into four divisions namely, Krta, Trētā, Dvāpara and kali There is Sandhyā in the beginning and Sandhyāmśa at the end of every epoch

Krta - Sandhyā - 400 years the main division - 4000 years, Sandhyāmśa - 400 years

Trētā - Sandhyā 300 years, the main division - 3000 years, Sandhyāmśa - 300 years

Dvāpara Sandhyā - 200 years, the main division - 2000 years, Sandhyāmśa - 200 years

Kali - Sandhyā 100 years, the main division - 1000 years, Sandhyāmśa - 100 years

According to the commentators, this number is of heavenly years and each

year in heaven is as long as 360 years of man (human years/years on earth) All these four epoches make a Dēvayuga and 1000 Dēvayugas make a Brahmā's day

The calculation of Jain doctrine and the calculation of the first chapter of the Manusmṛti, shown above are both almost alike The only difference is that the total number of years of the fourth, the fifth and the sixth ārās, counted jointly are 1 kōḍākōḍī Sāgarōpamas The number of years of Kaliyuga is equal to 100 years of Sandhyā, 1000 years of main division, and 100 years of Sandhyāmśa

According to the Jain religion there are 63 excellent men Their life history has been written and are available even today Their birth-time etc are important for Jain scriptures Of them 24 Tīrthankaras are chief Their birth, death etc occur at definite intervals of time The importance is, therefore, given to their birth etc in Jain scriptures We shall, therefore, regard them as illustrations for the purpose of time durations of incidents in the time-cycle and with reference to the length of the body, life-span etc of contemporary men Out of these 24 Tīrthankaras, 23 Tīrthankaras were born in the last and first 1 x^{14} Sāgarōpamas of the avsarpini and Utsarpinīkāla respectively, while the first Tīrthankara in Avasarpinīkāla, and last Tīrthankara in Utsarpinīkāla were born before and after some crore years from them

A circle has 360 degrees, in all The time-circle also has 360 degrees Each degree is divided into 60 minutes Again 1 minute is divided into 60 seconds, further second is also divided into subseconds, microseconds etc and incidents are shown with reference to the time of their occurrence First 180 degrees of time-cycle mention Utsarpinīkāla and later 180 degrees of time-cycle mention Avasarpinīkāla

00°-00'-00"-01"- Very difficult circumstances of life, underground residence of human beings and animals, gradually obtained slight im provement in auspi cious colour, smell, taste and expansion in life-span and construction of bone-joints (Sanghayana), fully non-vegetarian human beings The first spoke (epoch) of time-wheel

00°-00'-00"-45" - Generally miserable life, continuous rain of water milk and nectar for the first seven-seven days, creation of proper atmosphere, production of plant life, coming out of human beings and animals from their underground residence, human beings becoming vegetarian, end

of the first ārā and beginning of the second ārā

00°-00'-01"-00"' -End of the second ārā, intellectual development of people, gradual expansion of body and life-span

00°-00'-02"-00"' -Birth, nirvāna and duration of dispensation (śāsanakāla) of the first, second, third, fourth and fifth Tīrthankaras

00°-00'-03"-00"' -Birth, nirvāna and duration of dispensation of the sixth and seventh Tīrthankaras

00°-00'-04"-00"' -Birth, nirvāna and duration of dispensation of the eighth Tīrthankara

00°-00'-05"-00"' -Birth, nirvāna and duration of dispensation of the ninth Tīrthankara

00°-00'-07"-00"' -Birth, nirvāna and duration of dispensation of the tenth Tīrthankara

00°-00'-10"-00"' -Birth nirvāna and duration of dispensation of the eleventh Tīrthankara

00°-00'-15"-00"' -Birth, nirvāna and duration of dispensation of the twelfth Tīrthankara

00°-00'-30"-00"' -Birth, nirvāna and duration of dispensation of the thirteenth Tīrthankara

00°-00'-50"-00"' -Birth, nirvāna and duration of dispensation of the fourteenth Tīrthankara

00°-01'-30"-00"' -Birth, nirvāna and duration of dispensation of the fifteenth Tīrthankara

00°-03'-30"-00"' Birth, nirvāna and duration of dispensation of the sixteenth Tīrthankara

00°-07'-00"-00"' -Birth, nirvāna and duration of dispensation of the seventeenth Tīrthankara

00°-15'-00"-00"' -Birth, nirvāna and duration of dispensation of the eighteenth Tīrthankara.

00°-30'-00"-00"' -Birth, nirvāna and duration of dispensation of the nineteenth Tīrthankara

01°-00'-00"-00"' -Birth, nirvāna and duration of dispensation of the twentieth Tīrthankara

03°-00'-00"-00"' -Birth, nirvāna and duration of dispensation of the twenty-first Tīrthankara

05°-00'-00"-00"' -Birth, nirvāna and duration of dispensation of the twenty-second Tīrthankara

09°-00'-00"-00"' -Birth, nirvāna and duration of dispensation of the twenty-third Tīrthankara

18°-00'-00"-00"'-01"" -Birth of the twenty-fourth Tīrthankara and beginning of the fourth ārā of $2x10^{14}$ Sāgarōpamas

18°-00'-00"-00"'-50"" -Dīksā (initiation), attainment of omniscience, nirvāna and end of dispensation of the twenty-fourth Tīrthankara and beginning of kulakaras

18°-00'-00"-01"'-00"" -The end of kulakara-tradition and the beginning of the yugalika (twins) tradition

54°-00'-00"-00"' -The end of the fourth ārā of $2x10^{14}$ Sāgarōpamas and the beginning of the fifth ārā of $3x10^{14}$ Sāgarōpamas

108°-00'-00"-00"' -The end of the fifth ārā of $3x10^{14}$ Sāgarōpamas and the beginning of the sixth ārā of $4x10^{14}$ Sāgarōpamas

180°-00'-00"-00"' -The end of the last and sixth ārā of Utsarpinīkāla and the beginning of the equally long (in time duration) first ārā of Avasarpinīkāla

252°-00'-00"-00"' -The end of the first ārā of $4x10^{14}$ Sāgarōpamas of Avasarpinīkāla

and the beginning of the second ārā of 3x10[14] Sāgarōpamas

306°-00'-00"-00" - The end of the second ārā of 3x10[14] Sāgarōpamas and the beginning of the third ārā of 2x10[14] Sāgarōpamas

341°-59'-59"-30" -Beginning of the tradition of kulakaras

341°-59'-59"-59"'-05"" -Birth of Śrī Ādinātha, the first Tīrthankara

341°-59'-59"-59"'-56"" -The first Tīrthankara's Dīksā (initiation) and attainment of omni science

341°-59'-59"-59"'-59"" -The nirvāna (death) of the first Tīrthankara, Śrī Ādinātha

342°-00'-00"-00" -The end of the third ārā and the beginning of the fourth ārā

350°-59'-59"-56" -Birth, Dīksā and omniscience of the second Tīrthankara, Śrī Ajitanātha

350°-59'-59"-59" -Nirvāna of the second Tīrthankara

354°-00'-00"-00" -Birth Dīksā omniscience and nirvāna of the third Tīrthankara Śrī Sambhavanātha

356°-00'-00" -Birth, Dīksā, omniscience and nirvāna of the fourth Tīrthankara Śrī Abhinandansvāmi

357°-10'-00" -Birth, Dīksā, omniscience and nirvāna of the fifth Tīrthankara Śrī Sumatinātha

358°-05'-00" -Birth Dīksā, omniscience and nirvāna of the sixth Tīrthankara Padmaprabhasvāmi

359°-00'-00" -Birth Dīksā, omniscience and nirvāna of the seventh Tīrthankara

Śrī Supārśvanātha

359°-45-00" -Birth, Dīksā, omniscience and nirvāna of the eighth Tīrthankara Śrī Candraprabhasvāmi

359°-53'-00" -Birth, Dīksā omniscience and nirvāna of the ninth Tīrthankara Śrī Suvidhinātha

359°-56'-30" -Birth, Dīksā, omniscience and nirvāna of the tenth Tīrthankara Śrī Sītalanātha

359°-58-30" -Birth Dīksā, omniscience and nirvāna of the eleventh Tīrthankara Śrī Śrēyāmsanātha

359°-59'-10" -Birth, Dīksā, omniscience and nirvāna of the twelfth Tīrthankara Śrī Vāsupūjyasvāmi

359°-59'-30" -Birth, Dīkṣā, omniscience and nirvāna of the thirteenth Tīrthankara Śrī Vimalanātha

359°-59'-45" -Birth, Dīksā, omniscience and nirvāna of the fourteenth Tīrthankara Śrī Anantanātha

359°-59'-50" -Birth, Dīksā, omniscience and nirvāna of the fifteenth Tīrthankara Śrī Dharmanātha

359°-59'-53" -Birth, Dīksā, omniscience and nirvāna of the sixteenth Tīrthankara Śrī Śāntināthа

359°-59'-54"-30" -Birth, Dīksā, omniscience and nirvāna of the seventeenth Tīrthankara Śrī Kunthunātha

359°-59'-57"-00" -Birth, Dīksā, omniscience and nirvāna of the eighteenth Tīrthankara Śrī Aranātha and the nineteenth Tīrthankara Śrī Mallināthа

359°-59'-58"-30" -Birth, Dīksā, omniscience and nirvāna of the 20th, 21st 22nd, 23rd, 24th Tīrthankaras

359°-59'-58"-31" -Beginning the fifth ārā of 21000 years

359°-59'-58"-40" -Origin, development and destruction of the modern science

359°-59'-59"-30" -The end of the fifth ārā and the beginning of the sixth ārā Disturbance in atmosphere Falling of the Sun's ultraviolet rays directly on the earth Human beings and animals going underground and destruction of plant life (kingdom) Extremely difficult circumstances of life

360°-00'-00"-00"(000°-00'-00"-00") -The end of the sixth ārā and again beginning of Utsarpinīkāla

By comparing the two tables given above, one can see that the beginning of the evolutionary period of Darwin's theory marks the beginning of the first ārā of the Avasarpinīkāla part of the time-cycle of the Jain scriptures The beginning of formation of the crust of the earth marks the beginning of the second ārā The time of beginning of life and production of bacteria marks the beginning of the third ārā and the production of oxygen in the atmosphere marks the beginning of the fourth ārā of 1×10^{14} Sāgarōpamas

Modern science does not believe that life existed on the earth before the time mentioned above because the lowest of the layers of fossils and other fossils discovered during excavations of the earth belong to a time subsequent to the time mentioned above Rocks (fossils) of earlier times are not discovered The reasons for this can be given as under on the basis of the Jain scriptures the Brhatsangrahanī the Ksētrasamasa, the Pravacanasārōddhāra etc

The human life and life of beasts on the earth during the first, second and third ārās of Avasarpinīkāla were quite independent of each other Men and women among human beings and males and females among animals were born as twins became young together enjoyed together and gave birth to pair of twin (yugala) They brought up the twins (yugala) for a few days and then

made it free They died together They had only slight spiritual blemishes (Kasāyas) and only a slight desire of sexual pleasures They were almost devoid of anger, pride, illusion, greed and infatuation They never quarrelled or fought They never died a premature death Human beings and beasts had few needs which were supplied by kalpavrksas (desire-yielding trees) For all these reasons, the sword (asi) i e war, ink (maśī) i e writing and farming (kṛṣi) had not came to be used In those days nobody knew plants and no science of plants, history of plants, kinds and uses of plants existed But it does not mean that plant kingdom and animal kingdom had not at all developed in those days Also, natural calamities perhaps befell subsequently in the Avasarpinīkāla Fossils in form of ruins were, therefore, perhaps formed subsequently

In short, a fully natural life was lived during the first three ārās

The cosmic calendar has only one division, which is called the period of evolution In view of intellectual, physical and technological circumstances of the human society, it is called evolution but the Jain-time-cycle has two chief divisions – Utsarpinīkāla and Avasarpinīkāla The Jain scripture entitled Brhatsangrahanī states that in Utsarpinīkāla, there is a gradual development of physical strength height, life-span spirituality etc and bad tendencies of all living beings subside Contrarily in Avasarpinīkāla, physical strength height life-span etc diminish and spirituality deteriorates Bad qualities such as anger, jealousy, pride etc come into power i e become prominent

Modern science and its ecological and geological evidences support these observations The ruins in form of fossils of dinosaurs of many years ago, bear witness of their gigantic size The American Science magazine 'Discover' states that the ruins in form of fossils of birds with the length of 11 5 feet and with wing of the expanse of 23 feet, have been discovered According to the Jain terminology this dinosaur is a one type of reptiles The mongoose, the squirrel, the house-lizard etc belong to this phylum of animals As stated in the 'Jīva vicāra Prakarana' written by Ācārya Śrī Śāntisūriji in the twelfth century of Vikram Era and in the 'Jīvābhigama', the 'Pannavanā' and other Jain canonical scriptures written earlier by the year 450 A D , the largest size of these living beings is of the length 2 to 9 Gāus (1 Gāu = 3 2 kms) It is estimated that this dinosaur is 80 feet in height and 150 to 175 feet in length According to science, dinosaurs are of different kinds, different sizes and different peculiarities They belong to the mesozoic period According to the

present calculation, dinosaurs lived perhaps nearly seven crore years ago But the Jain scriptures mention quite a different calculation A Dhanusya (bow) is equal to six feet and the length of a dinosaur is nearly 25 Dhanusyas (bow) Supposing that the length of a dinosaur was equal to one-third of the height of man, when man was 75 Dhanusyas (bow) tall, the dinosaur was 25 Dhanusyas long Man's height in the interim of the times of the eleventh Tīrthankara Śrī Śrēyāmsanātha and the twelfth Tīrthankara Śrī Vāsupūjyasvāmi was nearly 75 Dhanusyas Therefore, it can be said that the dinosaur belonged to that period

According to another calculation when man was 3 Gāus in height (1 Gāu=3 2 kms) the reptile was 2 Gāus in length Therefore when man was 1 Gāu tall, the reptile was 2/3 Gāu long and when man was 500 Dhanusyas tall in the times of Bhagavān Śrī Ādinātha, the reptile was 333 Dhanusyas long This means that when the dinosaur was 25 Dhanusyas long, man was 37 5 Dhanusyas tall and man had this height in the interim of the times of Śrī Sāntinātha the Sixteenth Tīrthankara and Srī Kunthunātha the seventeenth Tīrthankara It, *therefore, does not at all seem to be improbable or impossible* that the existence of the dinosaur belongs to the period beginning before nearly 47 Sāgarōpamas and ending before nearly at least three Sāgarōpamas According to the cosmic calendar, the gigantic dinosaur was born on the 30th December and the Jain-time-cycle shows nearly the same It coincides with the 30th December of the modern cosmic calendar because 365 days of the cosmic calendar are equal to 180° (180°-00'-00"-01" to 360°-00'-00"-00") of Jain-time-cycle

Moreover, the methods of modern scientists for deciding the life-span of archaeological objects is faulty according to the calculations of the Jain-time-cycle and it is natural to be because according to the Brhatsangrahanī, the speed of transformation of objects decreases as time passes in Utsarpinīkāla i e first half of the Jain-time-cycle, and the speed of transformation of objects increase as time passes in Avasarpinīkāla i e later half of the Jain-time-cycle The Jain scriptures also give a theory for this The life-span of human beings varies from 16 to 20 years and they are nearly 1 hand (1 5 feet) tall in the beginning of Utsarpinīkāla When the first ārā of 21000 years and the second ārā of 21000 years come to an end, their height varies from 5 to 6 hands and their life-span is nearly of 80 years As time passes, the transformation

becomes slower and slower It is illustrated as under

After a lapse of the first fifty million million Sāgarōpamas years of the Utsarpinīkāla, the life-span rises from 20 years to nearly 72 hundred thousand pūrva years (1 pūrva=7056000,00,00,000= 70 56x10^{12} years) and his height rises from 1 hand to 450 Dhanusyas (bow) But after lapse of the next 50 million million Sāgarōpama years, the life-span rises only to 84 hundred thousand pūrva years and the height rises from 450 Dhanusyas to 500 Dhanusyas Similarly, at the end of the fourth ārā having 2x10^{14} Sāgarōpama years of Utsarpinīkāla, the life-span rises to nearly 1 palyōpama years and height rises to one Gāu, and at the end of the fifth ārā of Utsarpinīkāla, the life-span rises to nearly 2 palyōpama years and height rises to two Gāus The fifth ārā is 3 x 10^{14} Sāgarōpama years long At the end of the sixth ārā, having 4 x 4^{14} sagaropma years the life-span is of three palyōpama years and the height is of three Gāus Jain scriptures mention that in each period (ara) of 2 x 10^{14} Sāgarōpama, 3 x 10^{14} Sāgarōpama years, 4 0x10^{14} Sāgarōpama years, life-span rises by one palyōpama years and height rises by one Gāu Similarly, life-span and height decreases in Avasarpinīkāla, the later half of the Jain-time-cycle

Today on the basis of radiation of radioactive element of archaeological objects, scientists can say how old the objects are But according to what has been stated above, compared to the rate of radiation of radioactive element from those objects today, the rate of radiation of radioactive element from those objects was perhaps low a few years ago and it was perhaps extremely low many more years ago But without taking this into account, we work out the time of radiation of the past and, therefore, there is all possibilities of errors e g An archaeological object would perhaps have previously taken fifty years to emit as much radiation as it emitted during the last five years and it would have perhaps still previously taken 5000 years to emit as much radiation as it emitted during the fifty years I, therefore, suggest that more research work should be done on this subject and on this method Then we shall come nearer to reality

The basic difference between the modern cosmic calendar and the Jain time-cycle is that in the cosmic calendar everything happens over again, anew or *de nova* after utter destruction of the universe and suddenly animals of gigantic size are created and bacteria and viruses are believed to be their

origins/sources But according to the Jain time-cycle, all sorts of insects, animals and plants always exist and they develop in favourable circumstances The size of their body increases in Utsarpinīkāla and decreases in Avasarpinīkāla Plants are produced by plants and plants of a particular species produce plants of the same species Unicellular plants produce unicellular plants and multicellular plants produce multicellular plants There is no cross production between unicellular plants and multicellular plants

At the time of destruction of the earth, animals and human beings are preserved underground in sleeping, oval and manifest forms These animals and human beings cannot bear the temperature of the time of destruction of the earth But later on when the atmosphere becomes normal and the temperature becomes tolerable, they come out from underground and begin to develop themselves Animals procreate animals of their own species We cannot, therefore, say that in course of development of one species of animals procreate other species of animals Some scientists believe that animal-cells were produced from plant-cells and some other scientists believe that plant-cells were produced from animal-cells But all these beliefs are ultimately based on inferences It is possible that reality is quite different from all these inferences of scientists

In short Indian scientists belonging to different branches of science such as geology, physics, biology, atomic physics, geography, astronomy etc should make a deep study of ancient Indian philosophical and other books and do research work on the basis of it It is the need of the day If this is done, India will be able to make a very valuable contribution in the field of science

(Navneet-samarpana a Gujarati magazine, September '84 & Tulasī Prajñā Vol 23 No 4, Jan -March 1998)

Note-1 After five years of publication of this article, a context proving that this inference is true has been found in the book 'The Pyramid Power' It has been stated in the article 'The Jambūdvipa Laghusangrahani and Modern Science' p 139

15. Is There An Origin Of Life?

From the days when man abandoned the natural life style to adopt the life style created by himself, man's intellectual power began to develop Man made life style produced in man a sort of curiosity to know the secrets of life, the secrets of all natural phenomena and the factors controlling them This curiosity and the needs of the new life style inspired him to make new inventions That was the beginning of science and its inventions This curiosity played a very important role in material development in human life

Formerly man with his small family lived in forests and lived on fruits etc of trees growing in forests In those days no man had any fear from another man or any woman and no woman had any fear from another woman or any man In fact so much fearlessness prevailed that none was afraid of the so called violent birds and beasts Man in those days lived unclad but the mutual sexual attraction was not strong As time passed by, they changed They found shortage of fruits etc growing in forests and needs of people were not fulfilled From those days, people began to quarrel, fight and attack All struggled for their existence Thus emerged a new life-style and a new social order Gradually people adopted the new social order Man began to think of the natural and artificial phenomena occurring around him That precisely was the beginning of man-made science, which has been continuously progressing

Thus man's power of thinking laid the foundation of science and then man began to think of time of beginning of the universe and the great men of succeeding ages, with their powers of knowledge and logic, found answers to this and tried to explain them to other people of society Religious leaders, original founders of various religions, saviours of religions, great men who redeemed religion made their best efforts and contributed to the solution of problem regarding to the origin of the universe and life Bhagavān Mahāvīra presented a unique theory and solved many problems related to the universe Most of the religious leaders believe that the whole universe is without a beginning and is endless But scientists do not accept it They believe that

the earth has both, a beginning and an end The living world was created after crores of years of creation of the earth and it developed gradually This is what the scientists have been believing But according to the Jain philosophy, the world of living beings is never created Since beginningless time the living world has been on the earth and will continue to be there for endless time It has neither a beginning nor an end It goes on ascending and descending The periods of ascent and descent are respectively called Utsarpinīkāla and Avasarpinīkāla The present time is Avasarpinīkāla The geological fossils etc which are the evidences of the famous theory of evolution by Charles Darwin can be evidences of the Avasarpinīkāla of the Jain philosophy and they can disprove the theory of evolution because even the Darwin's theory of evolution is ultimately based on inferences and not on direct proofs or evidences In short the living world is neither created nor destroyed

Before thinking of the origin of living organisms, according to the Jain philosophy, let us examine various theories presented by different scientists the experiments made by them in order to prove their theories and their results and reasons for such results according to the doctrines of the Jain philosophy

Since many centuries, the problem of the origin of the living organisms has been a headache to scientists and philosophers In the beginning, philosophers believed that there was someone who created all kinds of animals, insects etc i e all living beings and they called him a creator But this theory of special creation is not acceptable to scientists nor is it acceptable to the Jain philosophy A great question arises to it is that if the creator made all then there must be someone to make the creator Who made the creator? Nobody can give a clear explanation to this

Regarding the beginning of the living organisms, scientists believed that the first living thing perhaps came from a heavenly body i e celestial object or the most microorganisms came as cosmic dust But this cosmozoic theory is also not acceptable to scientists because even on other planets there is no atmosphere conducive to life The problem of existence of living organisms on other planets has not been yet solved But according to the Jain geography and astronomy there are many regions which are vaster even than the earth and human beings animals plants, insects etc all the living beings there,

but no object can come from there to this earth All animals human beings, insects are confined to their region, out of which they cannot go Even if one goes by supernatural power or help of a god or goddess, one cannot survive there and if one survives there by virtue of some divine power, it is regarded to be very miraculous (see The Kalpasūtra, The origin of the Harivamśakula) In short the Jain philosophy also does not believe in any such theory as cosmozoic theory

According to the Jain philosophy, the whole universe (all the fourteen Rājalōkas) is inhabited by living beings They take birth on this earth too Their bodies are constituted of the substances existing here The body structure of some micro-organisms takes shape first and then the life-element /soul comes into it But in macro-organisms, the soul comes first and it develops its body and organs according to its capacity

There is another theory which is called the theory of spontaneous generation According to it the living world originated on the earth, all of a sudden, accidentally and in a very short time No external factor was necessary It was produced casually The Greek philosophers believed that the living organisms were produced from sea-slimes under the influence of the Sun, heat and atmosphere Scientists accepted this belief of the Greek philosophers But they did not accept the reasons that the Greek philosophers gave for creation of the living world Down to the sixteenth century, some people believed that frogs were produced in the mud of water, scorpions were produced in the excretion of animals and rats, house-flies and earth worms were produced from soil or clay But some experiments were made to know whether this was true or not One such experiment was performed by the Italian physicist Francesco Redi and he proved that the theory of spontaneous generation was wrong He showed that the maggots are produced only from eggs laid on rotten meat and fishes When meat and fishes are kept in a closed glass vessel and kept away from house-flies, maggots did not develop in it Ultimately he concluded that life originates from life and non-living beings can never give birth to life This theory is called biogenesis Later on Louis Pasteur went still further and proved that very minute micro-organisms can be produced from other germs of a kindred kind Thus Redi and Pasteur proved that living organisms were not produced in surroundings similar to the present day surroundings The question arises here whether it

is possible that the living organisms were formerly in different surroundings originated from nonliving substances This is the idea in the background of abiogenesis and scientists try to prove that living organisms were originated from non-living substances

In the book entitled, 'The Origin of Life' published in 1936 A D A I Oparin, a Russian biochemist said about the origin of living organisms that in the beginning of the earth, the atmosphere contained only hydrogen, water vapour, ammonia and methane There was no free oxygen but there was a little quantity of Carbon-di-Oxide (CO_2) The earth cooled down and then it rained Rivers, ponds and seas came into existence Ammonia(NH_3), methane(CH_4), hydrogen(H_2), water vapour(H_2O), salts, minerals etc mixed with water On account of ultraviolet rays, ozone and oxygen remained in the atmosphere According to Oparin, these conditions brought about decomposition of gases and production of organic compounds, which were building blocks for living micro-organisms in the beginning But can there be organic compounds in the form of such organic building blocks before the creation/origin of life? For solution of this question, a scientist named Stanley Miller made an instrument in 1953 A D and proved with experiments that with compounds of H_2, CH_4, NH_3 and H_2O(vapour) amino acids only in the liquid form and some organic compounds, DNA and RNA which could be seem in living organisms, could be prepared within a week

Another experiment proving the theory of A I Oparin was performed in 1964 A D by scientist named Sydney Fox He heated a mixture of some amino acids Then polypeptides were prepared after some chemical processes They took form of small chains They were called proteinoids because their nature resembled the nature of proteins The protenoids were put into hot water When the hot water cooled, some subtle microspheroids took shape

In the primitive initial surroundings conceived in the theory of A I Oparin, chains of long chemical *reactions were made and such big atoms as* poyneucleotides which contained DNA and RNA, were made

Though the microspheres and poyneucleotides were not like living cells, they were particles of organic substances which had acquired natural tendencies of elasticity etc These particles and microspheres mixed with one another and made more complex substances which could not grow in

sea water They were like DNA They doubled themselves It means that they could produce other substances, similar to them They were like viruses The cellular structure emerged from them They lived on organic substances and gave out CO_2 They were called heterotrophs It is believed that as a result of some flaw in there development, simple photosynthetic cells were originated Thus scientists believe that, first the primitive cells of living organisms of animal kingdom were originated and then the primitive cells of plant kingdom originated from them

But the contention of the Jain philosophy is altogether contrary to this Besides, the animal kingdom and the plant kingdom there are also in cosmos, kingdoms of earth-bodied, water-bodied, fire-bodied and wind-bodies living beings But that is irrelevant here The Jain philosophy believes that the animal kingdom and the plant kingdom and even their all species had separate existence in the present and they will have separate existence in the future They are produced and destroyed, their new kinds/species are developed and old kinds/species destroyed only according to changes in atmosphere, surroundings, mineral salts etc The primitive cells of plant kingdom did not *originate from the primitive cells of the animal kingdom*

According to the Jain philosophy, a living being is born in one of the three ways (1) Sammūrcchima Janma i e asexual production Without male-female copulation living beings are born in the place of their birth As late as in the 18th and 19th centuries, scientists have discovered and showed that living beings can be reproduced and their families can be extended without a male-female copulation It is called asexual reproduction Reproduction means to *produce a living being from a living being But according* to the Jain philosophy the living beings take birth according to the karma i e the deeds of their past births And reproduction is a subsequent step (2) Garbhaja Janma (sexual reproduction) After a male-female copulation, living beings are reproduced from spermatozoa and blood at the birth place i e Yōni They then develop in different female organs for various periods of time After their development, they come out of the embryo They take birth through the female reproductive organs Scientists call it sexual reproduction (3) Upapāta Janma (reproduction of celestial and hellish beings) Only celestial and hellish beings take upapāta birth It is, therefore, not necessary to describe it here But it is rather interesting to know how upapāta birth takes place In

their celestial abodes, beds of celestial beings are spread They are covered with bed-sheets When a god takes birth in a bed, his whole body, with garments, ornaments, garlands etc becomes ready in 48 minutes as if by a magician's magic Then the god turns and twists the body to shake off idleness and gets up This is how gods are born For hellish beings, there are recesses in the walls Hellish beings take their birth and make their bodies in the recesses of a wall They get only body and no garments, ornaments, garlands etc (For this see The Tattvārtha Sūtra ch 2, Sūtra-31)

This is how living beings are reproduced and born The reproduction and birth of living beings of asexual reproduction are identical i e same and one thing In sexual reproduction, souls of the living beings first come in wombs and in the due course of time they take birth They are of three kinds (1) jarāyuja (born with wrapper called placenta (2) andaja (born through eggs) and (3) pōtaja (born without placenta) Living beings born with placenta containing blood are called jarāyuja The man, the cow, the buffalo, the goat etc are jarāyuja Living beings born without placenta on their body are called pōtaja e g the elephant, the hare i e rabbit , the mongoose, the rat etc The snake the pigeon, the parrot the hen, the sparrow etc lay eggs After incubation for a certain period, a babe comes out of it This is called aṇḍaja garbhaja janma (sexual birth through eggs)

Before we proceed to talk about asexual reproduction let us talk about their birth places In Jain terminology, they are called Yōnis There are innumerable birth places (Yōnis) of living organisms or beings But based on same colour, smell, taste and touch, there are 84 hundred thousand types of birth places (Yōnis) There may be innumerable birth places with similar colour etc and these all are included in one type of Yōni The number of types of birth-places for earth-bodied beings is seven hundred thousand types Similarly, water-bodied beings are also born in the birth places of seven hundred thousand types Fire-bodied living beings are also born in the birth-plces of seven hundred thousad types Wind-bodied living beings are also born in birth places of seven hundred thousand types Pratyēka Vanaspatikāya(i e plants having a single soul in a single body) are born in birth places of ten hundred thousand types Pratyēka Vanaspatikāya means plants etc that have different souls in the root, the seed, the leaf, the flower, the fruit, the stem and the skin and the whole tree also has one soul Sādhārana Vanaspatikāya are plants with a single body containing infinite

souls that take birth, die, live and breathe together They are born in birth-places of fourteen hundred thousand types Two-sensed, three-sensed and four-sensed living beings are born in birth-places of two hundred thousand types each Celestial, hellish and Tiryañca (living beings other than celestial, human and hellish beings) having five-senses are born in birth-places of four hundred thousand types each Human beings are born in birth-places of fourteen hundred thousand types Thus in the living world, there are eighty four hundred thousand types of birth-places for all types of living beings Now we are thinking of asexual birth and asexual living beings i e *Sammūrcchima Janma and types of sammūrcchima living beings*

Sammūrcchima birth is birth without male-female copulation Sammūrcchima birth takes place amongst one-sensed (non-moving) living beings and moving beings i e two-sensed, three-sensed, four-sensed, Tiryañca i e beasts and birds having five senses and also human beings (see the Tattvārtha Sūtra, ch-2, Sūtras-32, 33, 34, 35 and 36) All sammūrcchima human beings are born in fourteen types of impurities or excretion The impurities are as under (1) faeces (2) urine (3) mucus (4) mucus (5) vomit (6) bile (7) pus (8) blood and flesh (9) semen (10) wetted particles of dried up semen (11) dead body (12) woman-man copulation (13) the city gutter and (14) all impure places The sammūrcchima type of living organisms among the five non-moving , two-sensed, three-sensed, four-sensed and beasts and birds i e Tiryañca having five senses, living organisms can take birth at any time and place Some of them need faeces, urine etc of their own species Here the cosmozoic theory and the theory of spontaneous generation are refuted and disproved Even scientists do not accept these theories

Now let us think what Greek philosophers say They might have seen living organisms being produced in water from sea-slime under the effect of heat, sun and atmosphere On seeing the generation of sammūrcchima living organisms in sea water, they perhaps concluded that the living organisms were originated from sea slimes but they could not give reasons for their conclusion because it was only their inference and they were quite ignorant of the real fact

Francesco Redi, the Italian physicist, performed an experiment He took two jars In both the jars, he put flesh and fishes He closed one jar in an air

tight manner and kept the other jar open After a few days, he found that maggots were produced in the jar that had been kept open and no maggots were produced in the jar that had been kept closed He believed that maggots were produced in the open jar because house-flies etc had laid eggs on flesh and fishes in it And there was truth in it On open flesh, fishes and edible things mix with excretion and chemical reaction takes place and when the mixture gets favourable atmosphere and temperature, sammūrcchima living beings are born in it They grow by getting nutrition from flesh etc Sometimes mould is produced on edible substances put in air tight jar Mould is produced because of favourable atmosphere and constant moisture All these productions of living beings are regarded as sammūrcchima births and all these places are among eighty four hundred thousand types of birth places (Yōnis) of production, stated in Jain scriptures

As soon as flesh or blood of any type gets separated from the body subtle sammūrcchima living organisms are produced in it It is no wonder, then, that the experiments performed by Francesco Redi obtained such results in the conditions of his days

As a result of experiments performed by himself, Louis Pasteur concluded that subtle living organisms can produce other subtle living organisms of their own kind and they are themselves also produced by germs of their own kind e g amoebae According to Jain scriptures the reproduction of amoebae can be explained in the following manner First, the size of amoebae expands Then its nucleus grows big When another soul comes into it the nucleus gets divided The two nuclei then go apart and try to keep their independence As a result protoplasm gets divided and they both try to live an independent life In short the subtle organism of Louis Pasteur's experiment were perhaps of the amoebae type and that is why his experiments led to this conclusion Here the theory of biogenesis of Francesco Redi and Louis Pasteur comes to an end

Before coming to the theory of abiogenesis, let us discuss biogenesis and abiogenesis of the Jain philosophy Both are discussed in Jain scriptures Both biogenesis and abiogenesis contribute to the production of sammūrcchima micro-organisms Sometimes like amoebae, other micro-organisms are produced from the same microorganism But sometimes even in the objects regarded to be lifeless, living micro-organisms are

produced after a long time, the duration of their lifeless existence This is the abiogenesis of the Jainism Even gods are born according to this abiogenesis theory But the beasts and birds that reproduce through embryo, i e garbhaja animals, namely jarāyuja (born with a wrapper containing blood called placenta) pōtaja (born without placenta) and andaja (born through eggs) take birth by themselves, take birth certainly according to the theory of biogenesis jarāyuja, anḍaja and pōtaja organisms are reproduced as a result of copulation of male and female and born through the female reproductive organ of animals

Let us examine Oparin's belief of abiogenesis and the results of the experiments of Miller and Sidney Fox Oparin only stated his belief and inference of how and in what circumstances the living organisms were originated He did not perform any experiment about it But Miller and Sidney Fox performed experiments to find out whether Oparin's belief was right or not They mixed together H_2, CH_4, NH_3 H_2O(vapour) and began to discharge them electrically They did so for a week Then they got some liquid This liquid contained four amino-acids and some organic substances They found that all these were non-living because gases water etc and remained hot Jain scriptures also say that water molecules contain life i e they are living Besides, water contains other micro living organisms But when water boils, they become lifeless But water particles and other subtle bodies of micro moving organisms regain life after a certain period This time limit is nearly 12 hours in winter, nearly 15 hours in summer and nearly 9 hours in the rainy season, it regains life after above mentioned time limit In short, Miller perhaps decomposed the solution of water, H_2, CH_4 and NH_3 for a week, heated it and examined it within a time limit mentioned above and therefore found the substances to be lifeless Had he examined them after the above mentioned time limit, he would certainly have found the substances contained life

In his experiments Sidney Fox heated the mixture of amino acids and proteinoids were produced The proteinoids were put into hot water which was then cooled In the cold mixture he saw that the subtle spheres and big molecules were produced according to Oparin's belief Both were mixed Living cells were thus made Here, too, poyneucleotides were added perhaps after cooling down the mixture of hot water Meanwhile living cells were perhaps produced and he probably saw the living organisms through a microscope The results of the experiments of Sidney Fox is, therefore, not

surprising Even if today experiments were made, as described above, the results would be the same

In short, all various experiments about the origin of the living organisms, made on the basis of different hypotheses, will lead to the similar results on account of the production of sammūrcchima living organisms As a result, the question of origin of living organisms will become more and more complex It will be at last necessary for all living organisms and the whole universe to believe that they are beginningless and endless according to the Indian tradition

(Navneet-Samarpana, Oct '85 & Tulasī Prajñā, Jan ,2000)

> WHEN THE EASTERN MYSTICS TELL US THAT THEY EXPERIENCE ALL THINGS AND EVENTS AS MANIFESTATIONS OF A BASIC ONENESS, THIS DOES NOT MEAN THAT THEY PRONOUNCE ALL THINGS TO BE EQUAL THEY RECOGNIZE THE INDIVIDUALITY OF THINGS BUT AT THE SAME TIME THEY ARE AWARE OF THAT ALL DIFFERENCES AND CONTRASTS ARE RELATIVE WITHIN AN ALL-EMBRACING UNITY SINCE IN OUR NORMAL STATE OF CONSCIOUSNESS THIS UNITY OF ALL CONTRASTS—AND ESPECIALLY THE UNITY OF OPPOSITES—IS EXTREMELY HARD TO ACCEPT, IT CONSTITUTES ONE OF THE MOST PUZZLING FEATURES OF EASTERN PHILOSOPHY
>
> FRTJOF CAPRA

16. Indian Classical Music And Its Scientific Significance

This happened nearly 400 years ago It is a wonderful and thrilling incident of the memorable meeting of Baijū Bāvarā, the supreme musician who holds a matchless position among accomplished musicians and Tānasēna, the court musician of the Mogul Emperor Akbar

Under the pretext of beating the world as a musician, Tānasēna set out from Bāngōgaḍha (Rājasthāna) in search of Baijū Bāvarā, the senior disciple of his guru Haridāsa, went to various royal courts and defeated the musicians there But nowhere did he find Baijū Bāvarā At last Tānasēna reached Āgrā and challenged the court musicians of Akbar, the Mogul Emperor of Delhi But the court musicians of Delhi had not the courage to compete with Tānasēna, who had natural talent, musical aptitude etc Emperor Akbar confessed the weakness of his singers and with open heart he accepted the supremacy of Tānasēna He made him his court musician

But Tānasēna was still uneasy because he had not yet succeeded in his aim of beating the world as a musician

But when Baijū came to know of Tānasēna's craze of beating the world in music, his sentiments as an artist were greatly hurt He made up his mind to humiliate Tānasēna and challenged him and according to the order of Emperor Akbar, arrangements for an extraordinary musical competition between them were made in the garden near the city Āgrā

It was a fine morning that filled the mind with joy The atmosphere of the garden was also full of natural beauty It was filled with soft and sweet sounds of birds The musical competition was to begin in this charming atmosphere

Emperor Akbar, his queens, the nine gems of Akbar's court and fanatic admirers of music - all came to the garden

There came a musician, wrapped in tattered and old clothes and equipped with only a stringed musical instrument (Tānapūrō) Tānasēna, the court musician, was astonished to see his strange appearance He was Baijū him-

self Since they were not familiar, the two disciples of the same guru did not recognize each other Still however, Tānasēna had great fascination and high regards for him

The competition started

According to the order of the emperor, Tānasēna first sang in the Tōḍī mode and filled the atmosphere with music Soon a small flock of deer, fascinated by the music, came to Tānasēna and stood there Tānasēna put a garland around the neck of a deer fascinated by music As soon as the music was over, the deer frightened of the human crowd, ran away into the forest

Baijū cheerfully looked at Emperor Akbar and said," O, Sovereign! Tānasēna sang in the Tōdī mode, fascinated the deer and called them here from the forest Now I shall sing in the Mrgarañjanī mode Under the influence of this mode only that deer will come which has the garland around its neck "

The Emperor allowed Baijū to sing in the Mrgarañjanī mode As soon as Baijū tuned his voice, the deer around whose neck Tānasēna had put the garland, came running from the forest and sat by Baijū's feet as if it were familiar since long, as if it were tame Baijū took the garland of the deer's neck and gave it to Emperor Akbar

Then the Emperor asked Baijū to sing something else and expected him to be answered by Tānasēna

Baijū then said, "O, Emperor! I shall now sing the Mālakaumsa mode Under its influence the stone lying in the front, will melt like wax and I shall put my stringed musical instrument into it When the music will be over, the melted stone will again solidify Let Tānasēna take my stringed musical instrument out without breaking the stone "

The audience was astonished to hear this

With full concentration, Baijū began to sing in the Mālakaumsa mode and soon the stone began to melt The stone completely melted into a liquid form As soon as Baijū went to put his stringed musical instrument into it, Tānasēna stood up and knelt at the feet of Baijū With great respect and high regards he said, "According to what my guru said to me, there is a

greater singer than I am He is my guru's disciple and senior to me His name is Baijūnātha Who are you?"

When Baijū heard this his eyes were filled with tears of joy Both the disciples of the same guru affectionately embraced each other [1]

There is a traditional belief of Jain Āgamas that Tīrthankara Paramātmās deliver their religious discourse only after attaining omniscience and their religious discourse never fails At least some people certainly accept the holy orders and Tīrthankara Paramātmās always deliver their discourse in the Mālakaumsa mode [2] Like the first religious discourse of Śramana Bhagavān Mahāvīrasvāmi, if the religious discourse of a Tīrthankara fails, it is believed to be an uncommon incident [3]

The Mālakaumsa mode has such a tremendous potentiality that under influence of its vibrations, even a stone melts into liquid What to talk of a human heart? The religious discourse delivered in the Mālakaumsa mode is capable of changing hearts of the greatest of men That is perhaps the reason why Tīrthankara Paramātmās deliver their religious discourse only in the Mālakaumsa mode

There is also a traditional belief that after conquering the city of Cāmpānēra, when Humāyu ordered indiscriminate wholesale slaughtering in the city, the great musician Baijū Bāvarā sang a mode named Jaunapurī which forced him the flow of sentiments of mercy from his heart to people Even the heart of Humāyu was filled with pity and he stopped the slaughtering and made the prisoners free [4]

Once when Tānasēna sang in the Dīpaka mode and enkindled lamps, two Nāgara brahmin girls of Vadanagara, Tānā and Rīrī, sang in the Malhāra mode, caused the rain to pour down and relieved Tānasēna from the heat of the enkindled lamps and Dīpaka mode and made the atmosphere calm [5]

As an effect of Bhairava mode , some musicians could squeeze juice from sugarcanes and oil from oilseeds with the help of machines working without bullocks By singing in the Hindōla mode some musicians could take long and high swings automatically by sitting in swinging cots [6]

The Śrī mode has a wonderful effect In the hot summer, it can make a dry garden full of greenery and rich with fruits and flowers [7]

What is music? How are various potentialities generated in music and what is their source?

Music is sound produced systematically and methodically with certain high or low intensity and at fixed intervals of time whether it is produced with a bin (kind of stringed musical instrument), a Sārangī, (kind of stringed musical instrument), a lute, Tambūrō, Sitāra, Dilarubā (kind of stringed musical instruments), Khañjarī (small tambourine), Mañjīrā (cymbals), Ḍhōlaka *(a large drum), Tabalā (kind of musical instrument),* a piano or a harmonium etc or it is produced by the musician himself with his mouth Though these sounds have no clear meaning, they have strange and wonderful potentialities

Music has its own physics If a musician knows phonetics or if a phonetician is a musician, they make very good combination

A well-planned combination of many notes of various frequencies and various intensities is produced in music By pressing various keys of a harmonium or a piano, we easily know that the note produced by pressing one key is different from the note produced by pressing another key From sharpness and flatness of a note, the musician knows which note has high pitch and which note has a low pitch It has been stated above that every key of a harmonium produces a note of a fixed frequency[8]

The key-board shown above, shows only one octave In it C, D, E, F, G, A, B c' etc are shown as general symbols The symbols - do, re, mi, fa, sol, la, ti, do'- are written below them are according to the western music The symbols sā सा, ri रि, ga ग, ma म, pa प, dha ध, ni नि, sā' सा', are shown according to the Indian music, the figures shown in the lowermost line show the frequency of the notes In Indian classical music and in Sanskrit literature, all these seven notes are known by special names sā सा ri रि, ga ग, ma म, pa प dha ध, ni नि are called Sadja, Rsabha, Gāndhāra, Madhyama, *Pañcama, Dhaivata and Nisāda respectively*[9]

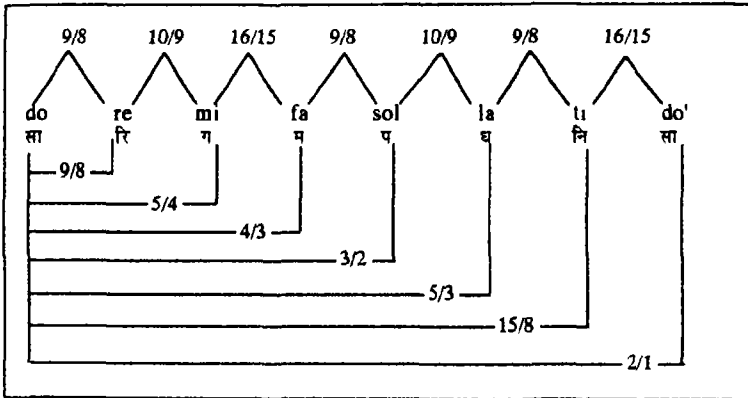
We can see that the same note has twice as much frequency as the frequency of the same note of preceding octave e g sā सा has the frequency 256 while the frequency of sā' सा' in the beginning of the second octave[10] is 512

The word 'interval' is used to show the difference of frequencies of two

notes, which are produced when a harmonium keys are pressed In music an 'interval' is a very important quantity An 'interval' shows the difference in pitch between two notes on a given scale For this let us study the intervals on the key-board of a piano or a harmonium The figure shows the frequency of the note produced by pressing a key We can see here that if we press two neighbouring keys of piano, we obtain a small interval between two notes Similarly, if we press two distant keys of a piano, we obtain a large interval between two notes We can, therefore, easily conclude that the interval is determined by the difference between frequencies of two notes But this is not the whole truth Really speaking, the interval is determined by the ratio of frequencies The intervals of the octave shown above, are determined as under

This is only a model Many such intervals can be determined on the basis of the ratio of different frequencies Some such intervals are given special names in the western music They are shown in the Table These names belong to the western music but in the Indian classical music also, corresponding keys of a piano, their notes and the ratio of their frequencies are shown instead of their names

Name of the intervals of notes	Duration of interval		Ratio of frequencies
	Symbol of the key of the piano	Name of the notes	
1 Half-tone, Minor Second	E-F	miग - faम	16/15
2 Minor tone, Major second	D-E	reरि - miग	10/9
3 Major tone	C-D	doसा - reरि	9/8
4 Minor third	E-G	miग - solप	6/5
5 Major third	C-E	doसा - miग	5/4
6 Perfect fourth	C-F	doसा - faम	4/3
7 Perfect fifth	C-G	doसा - solप	3/2
8 Minor sixth	E-c'	miग - do'सा'	8/5
9 Major sixth	C-A	doसा - laध	5/3
10 Minor seventh	E-d	miग - re'रि'	9/5
11 Major seventh	C-B	doसा - tiनि	15/8
12 Octave	C-c'	doसा - do'सा'	2/1

सा do	रि re		म fa	प sol	ध la		सा'' do'
C do सा	D re रि	E mi ग	F fa म	G sol प	A la ध	B ti नि	C do' सा''
256	288	320	$341\frac{1}{3}$	384	$426\frac{2}{3}$	480	512

In short, what is really important here is the ratio of frequencies of two notes One comes across a similar description in Jain scriptures It is a description of happiness of gods living in the residence of gods (Vimāna) named Sarvārthasiddha Before describing the happiness of gods of Sarvārthasiddha in the poem of Vēdanīya karma of poems of sixty-four kinds intended to ward

off the eight kinds of karma, Pandit Śrī Vīravijayajī Mahārāja shows the internal construction of the residence of gods there According to the description, the gods there always keep lying in the bed and a fine chandelier of 253 pearls hangs over them Its construction is worth knowing In the centre, there is a pearl weighing 64 maunds On the four sides of it, there are four pearls weighing 32 maunds each In the outer (second) circle there are eight pearls weighing 16 maunds each In the third circle, there are 16 pearls of 8 maunds each In the fourth circle, there are 32 pearls of four maunds each In the fifth circle, there are 64 pearls of 2 maunds each In the sixth i e last circle there are 128 pearls of one maunds each Blown by the wind when all these pearls strike against the inter-located pearls, they produce sweet musical modes and patterned arrangements characteristic of classical music They also produce drama The god in the bed enjoy seeing it [12] Here is a constant ratio of the weight and the number of pearls Notes of certain frequency are produced when two pearls strike against each other The natural combinations of the notes produce musical mode of the best quality Here it is stated that along with musical modes a drama is also produced This requires to be explained In all the nine Graivēyaka and all the five Anuttara abodes of gods only gods live and gods and goddesses from no other heavenly abodes can go there [13] It is, therefore, impossible that they make a drama But it can be explained as under

As it will be shown later on someone of the western musicians saw in the sky, the figures dancing to the tune of notes and such ones as Ashok Kumar Dutt, who are endowed with super - perceptivity, can see colours of sounds Similarly, the gods can see various fine figures made of groupings of pudgalas (Varganā) of Bhāṣā (speech) produced by sweet musical modes and their varieties These gods have such a superior quality of avadhijñāna that if they have a doubt, from their abode, they can ask a question to Tīrthankara Paramātmā and Tīrthankara Paramātmā answers the question through groupings of manas particles i e paramānu-units of Manō-Varganā namely thoughts The gods in their abodes know the answer to their question by seeing the thoughts of Tīrthankara Paramātmā in the form of parmanu-units of Manō-Varganā [14] Here the parmanu-units of Bhāsā Varganā of musical modes and their varieties take forms of various figures and the gods see them appearing and disappearing Moreover paramānu units of Bhāṣā Varganā are bigger than the parmanu-units of Manō-Varganā namely thoughts The gods,

therefore, can see them well and enjoy seeing them in the form of a drama This is my conclusion

Depending on the authority of P D Ospensky's book 'In Search of The Miraculous' and other books Lieut Col C C Baksi, writes in his book 'Vaiśvika Cētanā' [Coscon] that seven musical notes are of great importance in the universe [15] Every note has its colour and its planet and it influences various parts of our body The tables given by him are as under The table relating to the ratio of octaves is given on the top of it

Western notes	Indian Notes	Organ of the body	Colour	Planet	Voice of the animals	Element of the universe
do	sā सा	soul	Red	Mars	Peacock	Spreme being God, Pure soul
re	ri रि	head	Orange	Sun	Acertain bird	The moon
mi	ga ग	hands	Yellow	Mercury	Goat, Sheep	The earth
fa	ma म	chest	Green	Saturn	Heron, Crane	All Planets
so	pa प	neck	Blue	Jupiter	Horse,frog	The Sun
la	dha ध	waist	Skyblue	Venus	Horse	All suns
ti	ni नि	legs	Purple	Moon	Elephant	Whole universe
do'		sā' सा' -		-	-	-Supreme being, God, pure soul

Notes(western)	do	re	mi	fa	sol	la	ti	do'
Fractional ratio	1/1	9/8	5/4	4/3	3/2	5/3	15/8	2/1
Integer	24	27	30	32	36	40	45	48
Indian Notes	sā सा	riरि,	gaग,	maम,	paप,	dhaध,	niनि,	sā' सा',

Now - a - days, two varieties of music are generally well-known One is the western music and the other is Indian classical music

Since their aims are different, there is a vast difference between the western music and the Indian classical Music The western music is only for momentary joy and it fully gives sensual gratifications Since it is provocative, it appeals to the senses But the aim of the Indian classical music is attainment of the final emancipation It is characterised not by sensual pleasures but by the spirit of abandonment, feeling of aversion to worldly pleasures, self surrender and devotion Great men absorbed in devotional music do not care for any worldly thing They rejoice in themselves, the god of their faith and in worship Sometimes, the worship of such worshippers changes even poison into nectar [16]

According to the Jain philosophical contention, sound is produced from the paramānu units of Bhāsā Varganā And every paramānu of matter i e pudgala has colour, smell, taste, and touch [17] Every sort of sound, therefore, necessarily has good or bad colour, smell, taste and touch But they are so few or subtle that they cannot be perceived by our sense-organs True, every one feels the touch of sound There are some like Ashok Kumar Dutt who can perceive with their eyes, the colour of sound i e different colours of vowels and consonants [18]

Even the science of today accepts that matter i e pudgala atoms have inestimable energy In the sunday supplement of English daily, 'The Times of India' of September 3,1995, there was an article It clearly stated that air is charged with musical ions Of course, the writer described the western pop dance and disco dance and during the music, some spectators saw colourful various figures dancing in the atmosphere i e They perceived the colours of sound [19]

Of the Jain Āgama literature, the Āgama entitled 'Śrī Anuyōgadvāra sūtra', gives an elaborate information about the seven notes of music as under

"What are the seven types of notes? They are described as under 1 Ṣaḍja, 2 Rsabha, 3 Gāndhāra, 4 Madhyama, 5 Pañcama , 6 Dhaivata or Raivata and 7 Nisāda

1 The note that is produced jointly from the nose, the throat, the heart,

the palate, the tongue and the teeth is called Ṣaḍja

2 The note that acts like a bull (Rsabha or Vrsabha) is Rsabha There is a clear definition of Rsabha It says that the wind produced from the navel strikes in the throat and the head and bellows like a bull That is the reason it is called Rsabha or Vrsabha

3 That which has smell called Gāndhāra or that which carries smell is called Gāndhāra The wind produced in the navel and struck in the heart and the throat makes the Gāndhāra note producing many varieties of smells

4 That which is produced in the centre of the body is called Madhyama When the wind produced in the navel passes through the chest and the heart to return to the navel, it produces a heavy note That is called the Madhyama note

5 That which is the fifth among the seven notes, namely Saḍja etc is Pañcama *or the note that is produced in the five places namely, the navel,* the chest, the heart, the throat and the head is called Pañcama

6 The note that joins the above mentioned and other notes to one another is called Dhaivata or the Raivata note

7 Where notes are produced or sit side by side, the joint note is called Nisāda This note beats all the rest Its god is the Sun [20]

Telling the names of special/chief places of production of all the seven above-mentioned notes, the author of Śrī Anuyōgadvāra sūtra says that the Sadja note is produced from the forefront of the tongue, Rsabha is produced from the chest, Gāndhāra is produced from the throat, Madhyama is produced from the central portion of the tongue, Pañcama is produced from the nose, Dhaivata is produced by joint efforts of teeth and lips and that note is Nisāda in production of which eye-brows are contracted [21]

All souls from the two sensed to the five-sensed, having a tongue, can produce sound/voice Of course, we cannot hear sounds of minute two-sensed organisms because they are infrasonic or ultrasonic Notes of all souls are among the aforementioned seven notes or they are in form of combination of various notes The author himself shows clear voices of the nearest souls as examples of the above-mentioned seven notes

" The note of a peacock is Ṣaḍja, the note of a cock is Rsabha, the note of a swan is Gāndhāra, the notes a cow, a bull and a sheep is Madhyama, when the spring sets in, the sweet cry of a cuckoo is Pañcama, the note of the crane is Dhaivata and the note of the heron is Niṣāda "[22]

With reference to various non-living things i e various kinds of special musical instruments, examples of all the seven aforementioned notes are given as under

" The Mrdanga (kind of tabor) produces Ṣaḍja, the Gōmukhī (kind of drum) produces Rsabha, the conch - shell produces Gāndhāra, the gong produces Madhyama, the tabor (the small drum) produces Pañcama, the large drum produces Dhaivata and the Mahābhērī (kind of large kettle drum) produces Nisāda "[23]

Showing what influence all these seven notes have on living beings and what the living beings can gain from the influence, the author says, "He whose note is Sadja or tries to develop mainly the Sadja note can very well get wealth and his livelihood and the wealth that he has got is not destroyed He comes to have cows, sons and friends and he is a favourite of woman

The man whose note is Rsabha or who tries to develop the Ṛṣabha note, gets wealth, commandership, clothes, sweet-smelling objects, ornaments, women, beautiful beds, bedsteads etc

The man whose note is Gāndhāra or who tries to cultivate the Gāndhāra note, gets the best kind of livelihood, becomes an artist knowing various arts, a poet of a high rank and well versed in various scriptures

The man who has the Madhyama note or who tries to develop the Madhyama note, is happy, has enough to eat and drink and gives to others, things to eat and drink, i e he is charitable

Men with the Pañcama or men who try to cultivate the Pañcama note, become kings They are brave, they store many kinds of things and are leaders of various groups "[24]

Men with the last two kinds of notes are unhappy The two notes have the following bad influences

"Men with the Dhaivata note are unhappy and have a bad livelihood

They are thieves and murderers They commit many sins, hunt birds and beasts and kill deer and pigs

Men with the Nisāda note are quarrelsome They are bearers of burden, labourers and messengers [25] [27]

As shown above, these seven musical notes influence the body and the mind of men Moreover, they indicate the nature and the fate of men If efforts are made, these notes can change the fate of men

We see in our everyday life that when a small child is weeping, the mother sings a sweet lullaby and swings the child and the child soon stops weeping and goes to sleep Though the child does not know sounds but the pause and pleasingness of sound can make the child silent and send it to sleep

Today new experiments are made in therapeutics all over the world As a result, various therapies have come into existence in the world Among them allopathy, the modern medical science and Āyurvēda, the ancient Hindu system of medicine are very famous Moreover some other new therapies have been found out Of course, the roots of the so called new therapies lie in the ancient literary traditions e g 1 the acupuncture therapy, 2 the acupressure therapy, 3 the magnetic therapy, 4 the colour therapy, 5 the pyramid therapy

To these various therapies a new therapy, the music therapy is added Of course, this is not a new therapy in India On the basis of practical experimentation, western scientists have only substantiated this therapy

For music therapy, they have mainly relied on the Sāmavēda, the third Vēda and the Gāndharvavēda, the musical science, among the four Vēdas of ancient India [26] There is 70% water in our body and the modern science also agrees that water and the motion of the moon have a special kind of relation and that is the reason why there is flood tide in the sea on the full moon day and the last day of the dark half of every lunar month Indian astronomers, therefore, attach greater importance to the moon than the Sun And they have prepared the Indian calendar (Pañcānga) on the basis of the motion of the moon Of course, the motion of the Sun is also taken into consideration here but it has no special importance But western astronomers have attached importance only to the motion of the Sun in preparing the solar calendar

The development and other processes in the human body, the animal kingdom and the plant kingdom, depend on the motion of the moon Its attraction i e gravitational force has a special influence on all these Along with it, a special note / mode of music also has an influence on our body Accordingly our ancient musicians have fixed certain periods of time for certain modes of music Regarding music, Tulasīdāsa himself says

राग हरे सब रोग को, कायर को दे सूर । सुखिया को साधन बने, दुखिया को दुख दूर ।।

rāga harē saba rōga kō, kāyara kō dē sūra
sukhiyā kō sādhana banē, duhkhiyā kō duhkha dūra

[Modes of music cure all diseases, make cowards brave, supply sources of happiness to the happy and remove miseries of the miserable][27]

Every activity of our body is controlled by the brain which is controlled by the mind Of course, there are some who believe that the brain and the mind *are the same i e In every activity of our body, the mind directly or indirectly* plays its role and the composure and discomposure of our body depends upon our mental composure Our mind is also paudgalic (material) Regarding this Carl Gustav Jung states in his book entitled "Aion"

" Psyche cannot be totally different from matter, for how otherwise could it move matter? And matter cannot be alien to psyche, for how else could matter produce psyche? Psyche and matter exist in the same world and each partakes of the other, otherwise any reciprocal would be impossible "[28]

Since our mind is material, it goes on being vibrated or affected by various kinds of thoughts The vibration or effect is sometimes good and sometimes bad i e harmful The mind influenced by harmful vibrations becomes discomposed and consequently the body also becomes discomposed

Regarding this, Fritjof Capra, the celebrated physicist states in his book entitled 'The Turning Point'

" The notion of illness as originating in a lack of integration seems to be especially relevant to approaches that try to understand living organisms in terms of rhythmic patterns From this perspective synchrony becomes an important measure of health Individual organisms interact and communicate with one another by synchronising their rythms and thus integrating themselves into larger rythms of their environment To be healthy, then,

means to be in synchrony with oneself physically and mentally and also with the surrounding world When a person is out of synchrony, illness is likely to occur " [29]

Good vibrations which are by nature antithetical to vibrations which are harmful to the mind and the body, improve mental and physical health

Since our mind is influenced by various modes of music, music has great effect on our physical health Since ancient times the music therapy has been shown in Āyurvēda with the help of Gāndharvavēda, Sage Caraka, the promulgator of Āyurvēda gives in the sixth chapter of his work, entitled 'Siddhisthāna' a detailed description of medical uses of music The whole Gāndharvavēda fully deals with the science of sound Our classical and quasi-classical modes of music themselves are scientific form of these sound waves These sound waves have a direct effect on gas, bile and mucus in our body The book entitled 'Sangīta Svarāmrta' states

उच्चैस्तरो ध्वनि रूक्षो, विज्ञेयो वातजो बुधै । गम्भीरो घनशीलश्च ज्ञातव्यो पित्तजो बुधै ।।
स्निग्धश्च सुकुमारश्च धुर कफजो ध्वनि । त्रयाणा गुणसयुक्तो, विज्ञेयो सन्निपातज ।। [30]

uccaistarō dhvanih rūksō vijñēyō vātajō budhaih
gambhirō ghanasilasca jñātavyō pittajō budhaih
snigdhasca sukumārasca dhurah kaphajō dhvanih
trayānām gunasamyuktō vijñēyō sannipātajah

Sound waves of high intensity are dry and they are product of gas Deep and thick sound waves are product of bile Soft, smooth and melodious waves are product of mucus The sound waves which have all these three qualities are called a combined derangement What effects these sound waves produce on the body, is not shown here

Very loud sound waves of as high intensity as 100 to 110 decibels are mostly produced by loudly beating drums of bands Perhaps most of us know that if we are standing behind drums of a band, we feel as if hammers are beaten on our bellies and such sound waves produce fear and uneasiness in us These sound waves have a very great amplitude According to the Jain philosophical contention these sound waves have a very large number of groupings of particles of speech i e paramānu-units of Bhāsā -Varganā

In the last three verses of Śrī Ajitaśānti Stōtra compiled by Muni Śrī Nandisēna of Jain Svētāmbara sect mentioned the importance of chanting

this stotra in the morning and evening, that the person chanting and listening this Stōtra will never have any diseases or if he has any disease he will be cured of it

	Time	Modes of Music
1	4 00 a m to 7 00 a m	1 Hindōla 2 Bhairava, 3 Āhira Bhairava 4 Bhairavi 5 Siddha Bhairavi 6 Rāmakali 7 Gunakali
2	7 00 a m to 10 00 a m	1 Jaunapuri 2 Āśāvari, 3 Tōdi 4 Gurjara Tōdi 5 Ahilya Bilāvala
3	10 00 a m to 1 00 p m	1 Mēgha Malhāra 2 Śuddha Sāranga 3 Sura Malhāra
4	1 00 p m to 4 00 p m	1 Madhuvanti, 2 Multāni
5	4 00 p m to 7 00 p m	1 Pātamañjari 2 Mākhā 3 Rāgaśri 4 Kalāvati 5 Punyā Dhanaśri
6	7 00 p m to 10 00 p m	1 Yamana Kalyāna, 2 Kalyāna 3 Puriyā 4 Śivarañjani 5 Yamana 6 Śuddha Kalyāna 7 Maruvihaga 8 Kēdāra 9 Śāma Kalyāna 10 Priya Kalyāna
7	10 00 p m to 1 00 a m	1 Darabāri 2 Kānada 3 Nāyaki Kānada, 4 Mālakaumsa 5 Dipaka 6 Bhāgyaśri 7 Candrakaumsa 8 Kaumsi Kānada 9 Jayajayavanti
8	1 00 a m to 4 00 a m	1 Lalita 2 Nara Bhairava, 3 Sōhani 4 Vasanta 5 Vasanta Bahāra

In the present era, nobody has much faith in this theory but in the verses of Śrī Ajitaśānti Stōtra, the last word which comes, instructs the Rāgas (mode)/ Chandas of the verses All the Rāgas (modes i e tunes) are ancient

and to sing this, special tunes are there By singing or listening it in these tunes in the morning and evening, the effect of these verses will be felt by us immediately and can be experienced, first hand about this and so it can be said that the different Rāgas (tunes)/Chandas inscribed in Śrī Ajitaśānti Stōtra can be used as "Musical Therapy" The only thing required is that while singing this Stōtra, the knowledge of singing the modes and tunes should be original

Deep and dense sound waves have a high frequency These sound waves produce very sharp notes, When we hear these notes, we feel as if thick and long thorns pierce our body According to the Jain philosophical contention, every grouping of particles of speech, i e every paramānu-unit of Bhāsā Varganā has a very large number of paramānus i e atoms Though the number and size of paramānu-units are equal, they contain more atoms But sound waves which are not very big nor have a very high frequency give unusual calmness and ease to our body

Precisely this is a great difference between Indian classical music and the western music That is the reason why the western music seems to be very noisy and the Indian classical music is pleasing, quiet, calm and resolute

Of course in western music, there are also some modes like the modes of Indian classical music that are pleasing, quiet calm and resolute, but they are not popular in people e g Bethovan, Mozart, Backha *and others*

The following table shows which modes of music are useful in various diseases [31]

Thus Indian classical music is the greatest and the best means of physical and mental health on the one hand and on the other hand, the same classical music is the best means of worship too In ancient culture of India, the devotional poets have written a large number of prayer songs (Bhajanas), praise songs (Kīrtanas), hymns of praise (Stōtra), pynegyrics (Stuties), poetic forms (pada), prayer songs sung while waving lights before deity (ārati) etc in the language of the common people and also in Sanskrit, the language of the learned

Mīran Narasimha Mahētā, Sūradāsa, Tulasīdāsa, Ānandaghanajī, Upādhyāya Śrī Yaśōvijayajī, Pandita Uttamavijayajī, Pandita Rūpavijayajī,

Cidānandajī, Paṇḍita Padmavijayajī, Pandita Vīravijayajī Śrī Jñānavimalasūrijī, Śrī Vijayalakṣmīsūrijī, Upādhyāya Sakalacandrajī, Pandita Dēvacandrajī, Vācaka Udayaratnajī, Paṇḍita Dīpavijayajī, and many such other poets have created various kinds of poetic literature in the forms of hymns of praise (Stōtras) eulogies (stavanas), panegyrics (Stuties), songs of worship (Pūjās), songs sung at the time of circular dance (Rāsa) etc in popular Gujarati, Prakrit, and Hindi languages

A defect in a constituent of body	The balancing mode of music
Defect of Rasa	Dipaka Śuddha Sāranga
Defect of Blood	Punyā Mālakaumsa
Defect of Fat	Kalāvati Mēgha Malhāra Siddha Bhairava
Defect of Bone	Bhairavi
Defect of Marrow	Kēdāra, Darabāri Kānada Sāmavēda
Defect of Semen	Lalita Āśāvari

Ancient great sages such as Kalikāla Sarvajña Śrī Hēmacandrācāryajī and Śrī Haribhadrasūrijī have composed hymns of praise -panegyrics etc in Sanskrit and Prakrit languages

Now, in the modern times also such classical musical devotional songs are composed Recently, a few months ago, His Holiness Pannyāsa Śrī Śīlacandravijayajī Mahārāja published 'Bhīnī Ksanōnō Vaibhava', a book of devotional songs composed by him in ancient diction, based on beautiful classical modes of music

Showing the importance of this devotional music, Śrī Jñānavimalasūrijī says

जिनवरबिम्बने पूजता, होय शतगणु पुण्य, सहस्रगणुं फल चन्दने जे ले ए ते धन्य ।
लाखगणुं फल कुसुमनी, माला पहेरावे, अनंतगणुं फल तेहथी, गीत गान करावे ॥

jinavarabimbanē pūjatām, hōya śataganum punya,
sahasraganum phala candanē jē lē ē tē dhanya

lākhaganum phala kusumanı, mālā pahērāvē,
anantaganum phala tēhathı, gita gāna karāvē

[Hundred fold merits are earned by worshipping the idol of Jina Paramātmā, Thousandfold merits are earned by worshipping the idol with sandal paste Blessed is he who earns such merits He who puts a garland of flowers on the idol of Jina, earns a hundred times thousand fold merits He who sings songs of Jina earns infinite fold merits]

Disease	Modes of music useful in treatment
Anaemia	Priyadarsini Sāmavēda
Asthma	Puriyā Mālakaumsa Yamana
Cancer	Nāyakı Kānaḍa Siddha Bhairavi Ragaśri Sāmavēda
Nervousness	Āhira Bhairavi Puriyā
Heart disease	Bhairavi Śivarañjani Ahilya Bilāvala
High Blood Pressure	Hindōla Puriyā Kaunsi Kānada
Acidity	Māravā Dipaka Kalāvati
Mental Disease	Lalita Kēdāra
Ulcer	Madhuvanti Dipaka
Skin Disease	Mēgha Malhāra Multāni Madhuvanti
Diabetes	Jaunapuri Jayjayvanti
Colour blindness	Kaurnsi Kānada Multāni
High fever	Mālakaumsa Vasanta Bahāra
Leucorrhea	Āsāvari Rāmakali Sāmavēda
Insomnia	Bhairavi Dipaka Bhāgyasri

Why is so much importance given to music in God's worship? Pondering over this, we feel that music gives ease to the mind and then to the body and the man who is drenched deep in worship totally forgets mental anxiety, physical diseases and worldly troubles during that time and thus becomes absorbed in God The devotional music renders unusual help in cultivating concentration of mind, speech and body in spiritual field

And that is why according to the Jain traditional belief when Rāvana, the king of Lankā, went on a pilgrimage to Aṣṭāpada (Kailīsa), his wife, Queen Mandōdarī, performed a devotional dance before the God, Tīrthankara Paramātmā At that time Rāvana himself played on a lute and as soon as a string of the lute broke, Rāvana pulled out a vein of his leg and tied it in place of the string and kept Mandōdarī's devotional song unbroken By virtue of this devotion,Rāvana attained the merits of becoming a Tīrthankara Paramātmā in future It can make a worshipper a Tīrthankara

The Indian art of dancing is connected with Indian classical music The ex-actress and present day's Odyssey dancer, Miss Pratimā Gaurī says about the ancient art of dancing

" All ancient dances of India are in reality artistic varieties of God's worship God's prayer We Odyssey dancers and dancing girls perform dances to propitiate God Jagannātha The Kathak mode of dancing is full of Krsna's worship But in Bharatanātyam, the first artist of the universe, Śiva is pro pitiated The chief aim of our dances is God's pleasure " [33]

The modern science also supports the description of various potentialities of music given by ancient spiritual great men such as Indian musicians and sages possessing spiritual insight May living beings get happiness in this world and the next world and may they attain spiritual heights and welfare of soul through Indian classical music

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THE EASTERN RELIGIOUS PHILOSOPHIES ARE CONCERNED WITH TIMELESS MYSTICAL KNOWLEDGE, WHICH LIES BEYOND REASONING AND CANNOT BE ADEQUATELY EXPRESSED IN WORDS THE RELATION OF THIS KNOWLEDGE TO MODERN PHYSICS IS BUT ONE OF ITS MANY ASPECTS AND, LIKE ALL THE OTHERS, IT CANNOT BE DEMONSTRATED CONCLUSIVELY BUT HAS TO BE EXPERIENCED IN A DIRECT INTUITIVE WAY

FRITJOF CAPRA

17. Mantra, Yantra And Sound : A Scientific Analysis

Samsāra i e cosmos and time are both ever-flowing like the current of a river There is a proverb in English "We cannot cross the same river twice" Once we have crossed a river, we cannot cross it again i e When we cross the river again, the water is not the same In this ever changing cosmos, every living being wishes to be happy and no one wishes to be unhappy Of course, for every man and for the same man at different times, definitions of happiness and unhappiness go on changing If all these definitions of happiness and unhappiness are to be summed up in a one/single definition, one can say that attainment of what is desired and separation from what is not desired, is happiness, and separation from what is desired and attainment of what is not desired is unhappiness

Happiness and unhappiness comes to every soul in consequence of good or bad karmas i e deeds done by him previously Sometimes, worldly happiness may not be happiness in reality and sometimes externally appearing worldly unhappiness may not be unhappiness in reality because there is no difficulty about enduring the unhappiness in the hope and expectation of attaining happiness in future Really speaking, our state of mind alone is the source of our happiness

Every man in the world makes efforts to get the peace of mind Man always goes on making various efforts for it In their efforts, those who seek the shelter of yogis, accomplished great souls, get with blessings the strength of enduring and reducing mental, physical and worldly troubles

For destroying our unhappiness and for getting us happiness, ancient sages have taught us many kinds of mantras, mystical diagrams (yantras) and various branches of knowledge (Vidyās) Thus we can reduce or fully eliminate our bad karmas by means of many kinds of mantras (spells), yantras (mystical diagrams), tantras (religious text of mystical formulae for attainment of

superhuman powers), medicines etc Sometimes in the presence of an auspicious instrumental cause (nimitta) or an auspicious aspiration (bhāva) an inauspicious karma is transformed into an auspicious one [1]

Of course, it should also be mentioned here that such great men impart such highly important knowledge only to those who deserve If deserving persons are not there, after the death of those great men, that particular knowledge exists only in the form of legends

In ancient Indian literature one comes across many traditions about mantras, yantras and tantras and there are also various types of manuscripts about them Of course, though these manuscripts contain full rites for attainment of success through mantras, yantras and tantras yet one cannot attain success because in these highly confidential rites, one or two links are kept hidden and they are shown only to the disciples or some worthy men That is the reason why one does not attain desired success even if rites are performed as shown in the books published on mantras yantras and tantras

In the introduction to his book entitled 'Mantra-Vidyā' Śrī Karanidan Shethia writes about this

"The greatest difficulty in literature about mantras is of the key Ancient experienced sages and monks invented mantras and tantras But impor tant words from some of them are missing, some of them do not show the rite, and some of them mention but do not show the yantras about them " [2]

Nearly five years ago, I came across an ancient manuscript in which various prescribed ways of worshipping goddess Padmāvatī were preserved Various ways were prescribed in each ritual procedure and each one of them found to be incomplete Of all the five ritual procedures, only one showed its yantra (mystic diagram) The other four did not show the yantra [3] Later on I got from the collection of ancient manuscripts of my reverned Guru, His Holiness Ācārya Śrī Vijay Sūryōdayasūrijī, a small manuscript having only two leaves (pages), that prescribes the rite of Padmāvatī-Hrim I found this rite to be perfect and systematic but it did not contain the yantra Thus though mantras, yantras and tantras found in ancient manuscripts are true, one cannot attain success through them without guidance of an experienced guru

One need not, therefore, believe that these mantras are altogether wrong Really speaking, mantras, yantras and tantras are accompanied by aspirations

of the great men who invented them with a desire to make people happy The stronger the desire, the greater the power of the mantra and the influence of the yantra Many factors are responsible for attainment of success through a mantra Even if one of the factors is ineffective, success cannot be attained through the mantra

A mantra is a form of sound put into a script by a particular class of great men by combining particular words and letters for a particular purpose and it is supported by a presiding deity With their extraperceptual knowledge great saints of ancient time could see definite meanings or subjects of their special mantras and that is why Śrī Ashok Kumar Dutt who possesses extraperceptual knowledge uses the phrase 'Visionaries of meanings of mantras' for our ancient seers and monks

Explaining the secret of sound of mantras Śrī Ashok Kumar Dutt describes his own experience and says "While uttering a mantra or the name of Bhagavān or any deity, I see blue and white particles and they give nutrition to a body and along with it the glitter and sharpness of a mass of light of the subtle body rises I, therefore, realised that the prescription of the Jāpa (repetition) of the name of God and utterance of its mantra are perfectly scientific " [5]

In his book entitled 'Vaiśvika Cētanā' (Coscon) Lieut Col C C Bakshi states about mantras that when it is mentally or vocally pronounced every note, sound or word produces vibrations of a certain definite form Even while we think, indistinct words/sounds are produced in our mind Expert Sanskrit grammarians and philosophers call them bursting of sound (Śabda-Sphōta)[6] and these letters make a definite kind of impressions on our mind

Mantras can produce good as well as bad effects Moreover, desired effect can be produced through mantras on birds, beasts, plants, human beings and presiding deities of the mantras There are some mantras which cure us of diseases There are some mantras which protect us There are some mantras which can be used for subduing or killing some body or for malevolent purposes In a Kuśaṇḍikā sacrificial rite a man lighted fire only with some mantras and 'Ram' (र), the mystic mantra of fire

Talking of mantra-sounds, mantra-letters, yantra and idols, Śrī C C Bakshi states that sound of a mantra is unidimensional (Of course, we cannot

see sounds and that is perhaps the reason why it is unidimensional for us Yet for those who can see colours of sounds, sound is no doubt tridimensional) Letters of mantras and diagrams of mantras in the form of yantras are two-dimensional But idols are three-dimensional [8]

In my article "Kinds of Jāpa and Their Scientific Importance" I have already given a detailed description of types of Jāpa and their influence, alongwith a scientific analysis [9] I, therefore, do not discuss them here again

In ancient, times, perhaps in the times of the battle of Mahābhārata, the *science of arms and the mystic science of missiles were used* Here arms are ordinary weapons such as a sword, an arrow etc while the arms which were hurled with mantras or mystic science were missiles [10] After killing the enemy, these missiles returned to him who hurled them Kings, army-commanders and others of those times, also had the mystic knowledge of defeating the missiles

Thus, it seems that the mystic knowledge of mantras is very antiquarian in the Indian tradition

Chief among various traditions of mantra, yantra and tantra born and developed only in India are 1 Brahmin (Hindu), 2 Buddhistic and 3 Jain traditions The Brahmin i e Hindu tradition has three subdivisions 1 Vaiṣnava 2 Śaiva 3 Śākta

The Jain tradition of mantras, yantras and tantras is very antiquarian There is a book authored by Śrī Sanghadāsa Gani and entitled 'Vasudēva Hīndi' It is believed to have been written in the fifth century A D According to the reference found in it, when Śrī Rsabhadēva, the first Tīrthankara of this Avasarpinīkāla time, renounced the world, he distributed his wealth and kingdom to his sons and grandsons and others Nami and Vinami, his grand sons had been far away On returning, when they knew all that had happened, they went to Śrī Rsabhadēva to ask for their share Since Śrī Rsabhadēva was silently meditating, they began to serve him Once Nāgarāja Dharanēndra, (Lord of gods and goddesses of Nāgakumāra type) came to pay obeisance to Śrī Rṣabhadēva Pleased with the service of Nami and Vinami, he said, "Lord Rsabhadēva is a renouncer He has now nothing to give you But pleased with your worship of Lord Rasabhadev, I impart to you 48000 mystic kinds of knowledge (Vidyās)" He imparted the mystic knowledge to them, settled cities of Vidyādharas on the north range and the south range of Mt Vaitādhya

and appointed them to rule over the cities [11] Their tribe came to be called the tribe of Vidyādharas Among various branches of ancient Jain monks, one is known by the name of Vidyādhara [12] According to the Kalpasūtra, there is a reference to the branch of Ācārya is Vidyādharī [13] Thus, according to the Jain tradition, the origin of mystic science or science of mantra can be traced to times earlier than nearly one crore multiplied by one crore i e a thousand billion (10^{14}) Sāgarōpama years [14]

In the Jain Āgama tradition, the twelve Anga sūtras are regarded to be chief Among them, *Drstivāda, the twelfth Anga sūtra has special significance* Of course, this Anga sūtra is not available today It is lost The fourteen pūrvas in them were very important One of the fourteen pūrvas, was entitled Vidyāpravāda According to its name, this pūrva is perfectly an inexhaustible treasure of the science of mantra It was from this pūrva that Ācārya Śrī Bhadrabāhusvāmi who has knowledge of all the fourteen pūrvas, extracted the Grahaśānti Stōtra [15] There have been many powerful Ācāryas succeeding to the holy tradition of disciple of Śramana Bhagavān Mahāvīrasvāmi, the twenty-fourth Tīrthankara of Jain tradition According to Sthavirāvalī, given in the commentary to the Kalpasūtra, Ārya Vajrasvāmi had the mystic knowledge of bodily transformation (Vaikriya labdhi Vidyā) and Ākāśagāminī Vidyā (a knowledge of going from one place to another place through sky i e to fly in the sky) There are clear reference to show that Śrī Sthulibhadrajī, Śrī Priyagranthsurijī, Śrīguptācārya (a Guru of Rōhagupta), Ārya Samitasūrijī and others also knew mantra and tantras [16]

Moreover, Śrī Vrddhavādī, Śrī Siddhasēna Divākara, Śrī Mānatungasūrijī, Srī Nandisēna, Srī Mānadēvasūrijī, Śrī Skandilācārya, Śrī Pādaliptasūrijī, Śrī Nāgārjūna Śrī Haribhadrasūrijī, Śrī Hēmacandrasūrijī, Srī Jinaprabhasūrijī and many other Ācāryas are famous as experts in the science of mantra

When we think of the mantra literature of the Jain tradition, we are reminded of Namaskāra Mahāmantra Kalpa, Lōgassa Kalpa, Namutthunam Kalpa, Uvasaggaharam Stōtra Kalpa, Hrīkāra Kalpa, Vardhamānavidyā Kalpa, Rsimandala Kalpa, Santikaram Stōtra Kalpa, Tijayapahutta Stōtra Kalpa, Bhaktāmara Kalpa, Kalyānamandira Kalpa which belong to very famous and customary, literature Propitiation of Sūrimantra is regarded to be chief and compulsory duty for Jainācāryas By Sūrimantra chiefly Śrī Gautamasvāmi, the first disciple of 24th Tīrthankara Śrī Mahāvīrasvāmi, who

possesses infinite achievements (Ananta-labdhi i e infinite extra-ordinary powers), is propitiated Śrī Gautamasvāmi and all other Ganadharas i e main disciples of Tīrthankaras, the authors of the twelve Anga sūtras and all holy Ācāryas, well-versed in fourteen pūrvas, are called Śrutakēvalīs One of their epithets is ' Savvakakhara Sannīvāinam' i e He who knows all Vidyās (mystic sciences) composed of all various kinds of combinations of all letters '[17]

Besides, Śrī Gautamasvāmi, Saraswatī, the presiding goddess of all shastras, the knowledge obtained through all kinds of letters, Śrī Tribhuvanasvāminī Dēvī, goddess, predominating influence on all the three fold world and lives on Mt Manuṣōttara, Laxmi Dēvī (Śrīdēvī) goddess of wealth, Śrī Yaksarāja Ganipitaka , the god of the corpus of twelve Anga sūtras, Jain religious texts, presiding gods and goddesses of the dispensation of the twenty-four Tīrthankaras i e Yaksas and Yaksinīs, Sixty four Indras, the governor of nine treasures, sixteen Vidyādēvīs, i e goddesses of different types of mystic science, nine planets etc are also propitiated [18]

There is no doubt that those who perform this propitiation become great and powerful Besides, since Ācāryas helm the affairs of the Jainism they need to acquire the strength to ward off the calamities that may be fall the Jain dispensation Through propitiation of mantras, they get the support and presence of gods

In the present day society, there is a class of people who remain engaged in uttering mantras, yantras and tantras and they spread blind faith to serve their own interest There is another class of people who believes that mantra, yantras are absolutely false There are many people who do not understand the science of mantra They jest and joke and say that it is full of rumours and misapprehensions They do not know the power of words/sounds They, therefore, believe that those who believe in the science of mantra are foolish and backward and deride them Both these classes of people hold that their beliefs are true Of course, some change has come of late Those who believed mantras, yantras and tantras to be absolutely false, slowly but certainly accept mantras, yantras and tantras

Really speaking, their beliefs are based on only scientific proofs of mantras, yantras and tantras Currently, a special type of research work on mantras, yantras and tantras is in progress in the western countries The

secrets of mantras, yantras and tantras are presented in scientific ways through various books

A yantra is a graphic representation of sounds of words made of combinations of letters of a mantra [19] Recently I came across a book 'Yantra' published from England A scientist named Ronald Nameth passed the sounds of the Śrī Sukta mantra with the help of a scientific instrument through the electronic vibration filed and the sounds were transformed into diagram of the Śrīyantra A permanent picture of this is given in the book [20]

This means that the Śrīyantra is nothing but a figure form i e diagram of the sounds of Śrīsukta As sounds are printed on a gramophone record or a magnetic tape, so any mantra, if it is passed through the above-mentioned instrument can be transformed into a diagram There are some people who believe that mantras can be transformed back from their diagrams i e yantras, *as sounds can be transformed back from* a gramophone record or a magnetic tape Moreover, as modern science transforms energy into material particles(matter) and matter into energy, so yantras i e mystic diagrams can be transformed into mantras and mantras can be transformed into yantras Therefore, yantras and mantras can be replaced by each other [21]

Great sages of ancient times could, perhaps, see with their supernatural vision, the diagrams of mantras that they gratified with their recitation of mantras, the presiding deities, perhaps, showed them the diagram of the corresponding mantras Later on, the great mantra-reciters, perhaps draw the figures of yantras of the corresponding mantras on barks of birch trees or palm-leaves with writing materials Perhaps through this tradition the diagrams of yantras have come to us

Really speaking, a yantra is one kind of combination of various geometrical figures As mantras are made of combinations of different consonants and vowels, so various yantras are made of combinations of geometrical figures of different types Every yantra has its presiding god or goddess As the form or the name of the god or goddess changes, the mantra and the yantra also change All these mantras and yantras are in the form of matter i e pudgala and that is why they are inert and not alive i e having no desired effect [22] There are special processes of making them vital or effective Yantras can be made vital through their original mantras [23] In order to make mantras alive, the

letters of sanskrit alphabet are putting on the both sides of the mantras and when the mantra is recited 108 time, it becomes invested with life Other various methods for making mantras vital, are also given in the text-books on mantras and tantras [24]

Yantras are invested with effectiveness and idols of God and of gods and goddess are invested with life This rite can by performed with the best and special type of mantras only be competent Ācāryas Through special waves produced by mantra sounds Ācāryas transplants his vital elements into the idol only for a few moments Then the idol does not remain only a piece of stone but becomes actual God or god or goddess because the sound-waves of the mantras make the archetypal space of idol, an inexhaustible treasure of energy Then those who worship the idol can commune with Paramātmā, the Supreme being or god or goddess

The Jain tradition believes that an idol which is more than a hundred years old has inconceivable power because since it was worshipped by very many spiritual men with various mantras and pious sentiments during the period of more than a hundred years, the idol was filled by sound-waves of the mantras with an inexhaustible treasure of energy which uplifts the spiritual man and his desires are fulfilled The same is in case of yantras If on an auspicious day, a yantra is drawn according to the prescribed rite and with good intentions and if it is invested with effectiveness by a great sage, who has an expert knowledge of yantra, mantras and tantras, it soon gives a great fruit i e success because it is accompanied by the great sage's desire of doing good to people

Modern research scholars believe that the yantra is archetypal space and the mantra is a pious sound They also believe that the yantra and the mantra are not different They believe that if the yantra is a body of the mantra, the mantra is the soul of the yantra [25] Besides, according to the Indian tradition, a yantra is a place where gods and goddesses reside in a subtle way Especially among chief seats of main goddesses Ambikā, Durgā, Kālī, Mahākālī and others, yantras of the goddesses are more highly esteemed than idols of the goddesses

These symbols in the form of yantras are an inexhaustible treasure of psychic energy These yantras find out our missing element and supply it Thus they make our life joyful, energetic and meaningful

Generally two types of yantras are found in the present times Yantras are always a combination of diagrams But letters of mantras are also written in them But as shown above, diagrams of yantras are nothing but a visible form of letters of mantras In order to help a common man to know which mantra letters are visibly represented by a particular yantra, the learned sages and monks also write mantra-letters in yantras That is the reason why we find, yantras along with mantras simultaneously While in some yantras there are numbers written in squares or various geometrical diagrams There are various types of yantras related to these numbers, e g the yantra of fifteen, the yantra of twenty, the yantra of thirty four, the yantra of sixty five, the yantra of one hundred seventy In the yantra of fifteen, numbers from one to nine are used and they are so arranged that each set of three numbers added vertically, horizontally or transversely, gives a total of fifteen That is why they are called yantras of fifteen

Books on mantras and yantras show four varieties of yantras of fifteen Each variety of these yantras has different elements, colours and effects Besides, when those yantras are written on a piece of paper or on a bark of the birch tree with special kind of materials, if the order of writing numbers in the same variety of yantras is different, different effects are produced [26]

8	1	6
3	5	7
4	9	2

This yantra of fifteen is known by the technical Brahmin

This yantra of fifteen is known by the technical term Ksatriya

4	3	8
9	5	1
2	7	6

2	9	4
7	5	3
6	1	8

This yantra of fifteen is known by the technical term Vaiśya

This yantra of fifteen is known by the technical term Śūdra

6	7	2
1	5	9
8	3	4

Such other yantras are made in respect of the Sun, the Moon, the Mars and other planets in order to propitiate them The yantra for the sun is a yantra of fifteen It is different from all the four yantras shown above For the moon, there is a yantra of eighteen For the Mars, there is a yantra of twenty-one

The Sun Yantra

6	1	8
7	5	3
2	9	4

The Moon Yantra

7	2	9
8	6	4
3	10	5

The Mars Yantra

8	3	10
9	7	5
4	11	6

Similarly, there are yantras for other planets, too [27] Besides, there are also other ways of making yantras of fifteen But each of them gives different success and effects And it is a subject for research

Thus various kinds of numerical symbols i e yantras have various kinds of mystic energy or powers

In the Jain Tradition also, both the types of yantras are found Among yantras related to mantras, there are many kinds of yantras such as Śrī Siddhacakra Mahāyantra, Śrī Ṛṣimandala Yantra, Śrī Vardhamānavidyā Yantra, Śrī Sūrimantra Yantra, Śrī Padmāvatī Yantra, Śrī Vairōṭyādēvī Yantra, Srī Ghantākarna Mahāvīra Yantra, Śrī Gautamasvāmi Yantra, Śrī Labdhipada Yantra, Śrī Mānibhadradēva Yantra, etc Numerical yantras are also found in the Jain tradition The mostly found yantras of this type are the yantra of one hundred-seventy i e Sarvatōbhadra Yantra concern with Śrī Tijaypahutta Stōtra the yantra of sixty five concern with twenty-four Tīrthankaras, and the yantra of fifteen concern with Navapada etc

Sometimes it happens that an author or a research scholar who is not familiar with sectarian traditions of mantras and yantras, does not properly understand the yantras, the letters written in the yantras and the methods of the yantras e g In the book entitled 'Yantra', the Labdhipada yantra related to the Sūrimantra, is published There the mantras of the Labdhipadas are given in the Prakrit language Moreover, the letters of each pada are given in the reserve order e g The pada ॐ नमो जिणाणं (OM namō jinānam 1) is written as '1 nam nā ji mō na OM' णं णा जि मो न ॐ All these padas are found in the Sūrimantra Of course, this yantra was drawn at least 200 or 250 years ago These yantras sometime contain the name of one who invests them with effectiveness or the name of one for whom it is drawn One finds the name कल्याणदाश (Kalyānadāśa) inserted in the above mentioned yantra On the basis of the name, the whole yantra is named Kalyānacakra (कल्याणचक्र), the wheel of fortune [28] But this is improper

In the 'Sūrimantra Kalpa-samuccaya' this yantra is given in a new form The letters are written there in the original-actual order but not in reverse order as shown in above-mentioned yantra [29]

There are also two ways of reciting mantras 1 pūrvānupūrvī i e Mantras are recited according to the order in which padas or letters of the mantra are given 2 paścānupūrvī i e Mantras are recited in the reverse order of padas *or letters of the mantra Both these types of recitation of mantras give different* types of result Generally, the pūrvānupūrvī recitation of mantras gives spiritual success and paścānupūrvī recitation of mantras gives worldly or material success

In modern science, there is a branch of telepathic science Likewise in therapeutics, a Bengali homeopathic doctor Śrī Binitosh Bhattācārya has developed the teletherapy In this therapy he uses medicines but along with medicines he also uses such mantras and yantras as shown above The mantras and yantras are arranged on a special type of instruments and a special type of vibrations are produced form them With the help of a photo or the name of the patient arranged in front of the vibrations, they are invisibly directed towards the patient Surprising improvements in patients have been detected as a result of using this therapy

Yantras are symbolic marks In different traditions, these symbolic marks i e diagrams are interpreted in different ways The reason for this is the knowledge or experience that they have gained e g If a physicist is asked about 'energy', he will introduce 'energy' as an inherent active force of matter If a psychologist is asked about it, he will introduce energy as 'mind' producing effect on the brain through an external factor/a stimulant If a spiritual sage/yogi is asked about it, he will say that realization of the Supreme Brahmā i e universal consciousness (Vaiśvika Cētanā), through Yōga, is an energy

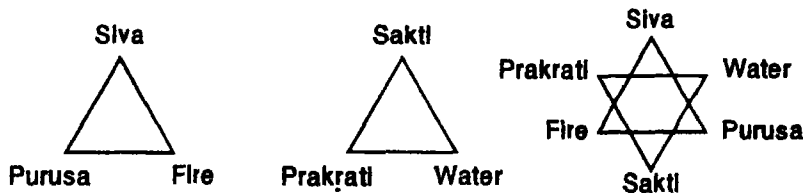
Thus, we all who possess very little knowledge and knowledge-obscuring karmas are not fully removed from whose souls, interpret the symbols of tantras and yantras according to our intellectual level Only the Omniscient great men can know the full and real significance of the symbols Omniscient great men clearly know all modifications of all substances and all living organisms related to the past the future and the present tenses in the whole

hand [30] For them, the past tense and the future tense do not exist at all All is in the present tense If omniscience is to be described in a single sentence in the modern scientific english terminology, one can say that "Omniscience is nothing but the hologramic effect or power of the soul regarding to time, space, matter and all souls" Only those who have the supreme knowledge i e omniscience, know the full significance of symbolic marks of these yantras Of various kinds of yantras, it is the Śrīyantra which is most discussed by common as well as learned people and experts in sciences of mantra and tantra

Śrīyantra is regarded as a very mysterious treasure of occult lore Foreign scientists are doing their best to find out the mystery of this yantra and they are comparing the Śrīyantra with the principles of science and of spirituality A point is shown in the centre of the Śrīyantra It is called Mahābindu According to the vedic tradition, it is regarded as a symbol of the origin of the universe and it is also called zero (Śūnya) It is also divided by the universal impulse i e The seed-energy of Śiva rises from deep sleep and becomes active

When the point is divided, pairs (Visargamandala) are created They are known as pairs Śiva-Śakti, fire-water or Puruṣa-Prakṛti

The original triangle represents the universe trio It is the origin of all objects

The division or bisection and development of the original triangle in the form of Siva - Fire-Purusa and Śakti (energy)-water-Prakṛti [31]

The basic subtle elements of the mind māyā (illusion), Kalā (art), Vidyā (knowledge), rāga (attachment), kāla (time), niyati (destiny) - are created by combinations of Śiva and Śakti or fire and water or Purusa and Prakṛti

Physical elements are created by combination of Purusa and Prakrti - 1 Intellect 2 Pride and 3 the thinking faculty (the mind) are created from Sattvaguna (the first or highest of the three costituent qualities of nature) The five sense organs (of tuch, taste, smell, sight and hearing), the five organs of body (hands, legs, mouth, abdomen and the reproductive organ) are created from rajōguna (the second of the three constituent qualities of nature) The gross as well as the subtle earth, water, fire, wind and space are created from tamōguna (the third of the three constituent qualities of nature)[32]

This interpretation is according to the vaidic tradition

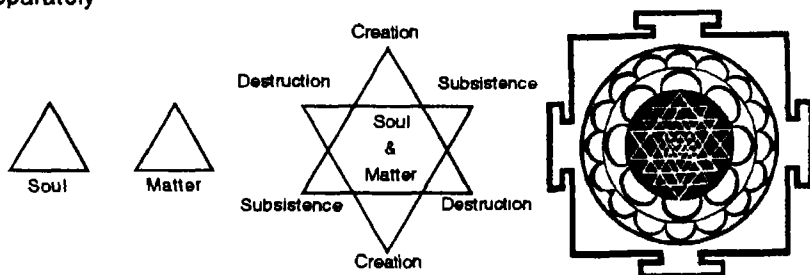
Experts on science of mantra and yantra, the worshippers of mother goddesses, say that Śrīyantra is the abode of goddesses and accomplishments (Śaktis) These accomplishments are eight -1 animā (the super human power of making a very minute form), 2 mahimā (the super human power which enables one to enlarge one's size maximum), 3 laghimā (the super human power which enables one to modify a very light form), 4 garimā (the super human power which enables one to modify a very heavy form), 5 prāpti (the super human power of touching the mountain-peak with one's finger), 6 isitva (the super human power of sovereignty) 7 prākāmya (the super human power of obtaining all desired thins) and 8 vaśitva (the super human power of bringing all under one's control) The goddesses are eight-Brāhmī Māhēśvarī, Vaisnavī, Cāmundā, Mahālaksmī etc and they reside in the eight triangles This circle of eight triangle is called Sarvarōgahara Cakra It is this Srīyantra which they know by the name of the yantra of the goddess Tripurāsundarī

The ten triangles of the Sarvaraksākāra cakra of the second inner circle indicate the ten Mahāvidyās (great branches of knowledge) The ten triangles of the Sarvārthasādhaka cakra of the inner third circle are the ten prānas (vital elements) The circle of fourteen triangles on the outer most side is called the Sarvasaubhāgyadāyaka cakra Mahātripurāsundarī or Mahālakṣmī resides in the point in the triangle in the centre of the Śrīyantra [33]

Experts on yoga science compare Srīyantra with the six cakras contained in our vital body namely Mūlādhāra cakra, Svādhisthāna cakra, Manipura cakra, Anāhata cakra, Viśuddhi cakra and Ājñā cakra While Mahābindu is compared with Sahasrāra cakra which is on our head and already outside the physical body [34]

These symbolic marks can be linked with Jain philosophy as under

The point or the Mahābindu indicates the pure soul or the pure matter Of course, the pure soul is colourless and shapeless, while pure matter i e pudgala has a shape and it also has a colour, a smell, a taste, and a touch But as far as energy is concerned, both are equal The pure soul possesses infinite energy and pure matter also possesses infinite energy The infinite energy of the soul is self-directed while infinite energy of the matter is directed by other forces

A pair of Mahābindus is formed when the soul and the matter are shown separately

The soul and the matter have three phases each to be created, to be destroyed and to remain stable as original element In Jain terminology, this is called Tripadi 1 uppannē i vā (उप्पन्ने इ वा) 2 vigamē i vā (विगमे इ वा) 3 dhuvē i vā (धुवे इ वा) and it is indicated by the three sides of the triangle Every object in the world has these three phases or stages The Vaidic tradition also believes in creation, subsistence and destruction of the world Brahmā , Visnu, Mahēśa are regarded as gods of creation, subsistence and destruction respectively The Jain tradition does not believe in the creation of the whole universe but it believes in various modifications of various elements like soul and matter It believes that the universe as a whole is beginningless and endless

According to the Jain philosophical belief, the combination of the pure soul with a pudgal i e matter is never possible But it is believed that it is since beginningless time that the soul is associated with pudgala i e matter All

objects of the universe are originated and destroyed only as a result of this beginningless association

Karmas are paudgalic (material) and through karman Varganā, matter is transformed into the eight types of karma The eight types of karmas are 1 Jñānāvaranīya, 2 Darśanāvaranīya, 3 Vēdanīya, 4 Mōhanīya, 5 Āyusya, 6 Nāma, 7 Gōtra and 8 Antarāya [36] They are indicated by the eight triangles of the first circle around the pudgala triangle of the Śrīyantra Ten types of Sañjñā (inclinations) are produced in the soul accumulating the eight types of karma The ten types of instincts are - 1 Āhāra (nourishment), 2 Bhaya (fear), 3 Maithuna (sex), 4 Parigraha (attachment), 5 Krōdha (anger), 6 Māna (pride), 7 Māyā (deceit), 8 Lōbha (greed), 9 Ōgha Sañjñā (common sense), 10 Lōka Sañjñā [36] (inclination for Samsāra) They are indicated by the ten triangles of the second circle near the eight triangles of the first circle As a result of these inclinations, a Jīva (the soul with karma) gets the ten vital elements, the five sense organs, the three powers/energies namely manas i e the mind, vacana i e the speech, kāyā, i e the body, breathing i e respiratory system and life-span [37] They are indicated by the ten triangles of the third circle Samsāri Jīva i e the soul with karma possesses these ten vital elements The souls with karma are of fourteen categories [38] All these fourteen categories of Jīvas are indicated by the fourteen triangles of the fourth circle All the souls except pure souls, of the whole universe belong to these fourteen categories of Jīvas

Around this, there is a circle representing eight petals of a lotus Anger, pride, deceit and greed which were previously introduced as instincts (Sañjñās) of the soul act here as deadly enemies of soul These four added to the four namely attachment, aversion, infatuation and ignorance, make a group of eight All these together are great enemies of all the fourteen categories of Jīvas i e all the Jīvas of the whole universe All these eight obstruct spiritual development of the soul In order to conquer them, one should first of all become introvert gain knowledge and remove ignorance In order to do so, it is necessary to concentrate on the 16 vowels namely अ आ इ ई उ ऊ ऋ ॠ ऌ ॡ ए ऐ ओ औ अं अः (a ā i ī u ū r r̄ lr lr̄ ē ai ō au am ah) which are symbolic of the letters of the Sanskrit alphabet or Dēvanāgarī script Along with these sixteen vowels, the thirty-three consonants are also concentrated on This is indicated by the circle of the sixteen petals of the lotus

By concentrating on the letters of the Sanskrit alphabet, one shakes of Jñānāvaranīya karmas and attains omniscience and its light, crossing the boundaries of the universe beyond innumerable islands and oceans that are in the universe, reaches even at the portion above the universe i e beyond the universe called alōka The circular bangle-shaped figures are symbols of the innumerable islands and oceans Through the gates shown on all the four sides of the shape of Lōka (universe) in the square form, it is suggested that the illumination of omniscience spreads even towards Alōka

Thus the Śrīyantra also contains the Jain philosophy and as shown above, every one who engages in contemplation and concentration, destroys his inauspicious karmas and along with spiritual prosperity, he gains happiness and wealth in this world and next world or birth and the success that he desires

The ancient literature shows mantras meant for propitiation of hundreds of various gods and goddesses of the Indian tradition as well as the Jain tradition If we get a tonoscope or a modern scientific instrument with an electronic vibration field and a qualified research-scholar to operate it we can get the real form of yantras of all mantras And that will open a new horizon or field for research work in the science of mantras

Thus, yantras, mantras and tantras are a wonderful heritage of our ancient knowledge Moreover, even from the view point of modern science, they produce wonderful and distinct effects not only on human beings and the living world but also on lifeless matter Let us, therefore, hope and wish that intelligent research-scholars and scientists will do more dependable and experimental research work and disclose to the world more secrets of yantras, mantras and tantras

Date 3rd November, 1996, Bhavnagar

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1 See 'Sankramana karana' in the book 'Karmaprakrti'

2 'Mantra-Vidyā' by Karanidan Sethia, Introduction, p 20

3 'Acintya Cintāmani Bhagavati Padmāvatī ' Ed Nandlal Devluk, Arihant Prakashan, Bhavnagar, p 361-386

4 'Jainism Through Science' (Gujarati section) by Muni Nandighoshvijay (Śrī

Mahāvīra Jain Vidyalaya, Bombay-400 036), p 45

5 'The significance of the alphabet and utterance of mantras' by Ashok Kumar Dutt, Forbus Quarterly No 4, October-December 1992 p 279

6 The mantras are also intimately associated with the theory of eternal word Sphōtavāda expounded by the philosophers of Sanskrit grammar, who traced *the gem of speech or words back to divine source* (an imperishable unit of speech Sphōta also known as Vāk or Pranava or Śabda Brahma) 'Yantra' by Madhu Khanna, p 41

7 *Vaiśvika Cētanā (Coscon)* by Lieut Col C C Baksi, p 95

8 Ibidem, p 97

9 'Jainism Through Science' (Gujarati section) by Muni Nandighoshvijay (Śri Mahāvira Jain Vidyalaya, Bombay-400 036), p 123-126

10 (Astra-mantra अस्त्र मन्त्र) Mantra by which a missile is consecrated before it is thrown (The Standard Sanskrit English Dictionary, p 88)

11 'Mantra Vidyā' by Karanidan Sethia, Introduction p 12 13

12 Ibidem Introduction p 13

13 थेरेहितो ण विज्जाहर गोवालेहितो कासवगुत्तेहितो इत्थ ण विज्जाहरी साहा निग्गया

thērēhintō nam vijjāhara gōvālēhintō kāsavaguttēhintō ittha nam vijjāhari sāhā niggayā (Śrī Kalpasūtra Eighth part, Sthavirāvali) p 510

14 Innumerable years make a palyōpama 10 x 1 crore x 1 crore i e 10^{15} palyōpamas make a Sāgarōpama One kōdākōdi Sāgarōpamas equal 10^{14} Sāgarōpamas or 10^{29} palyōpama years

15 भद्रबाहुरुवाचैव पञ्चम श्रुतकेवली । विद्याप्रवादत पूर्वाद ग्रहशान्तिरुदीरिता ।।
bhadrabāhuruvācaivam pañcamah śrutakēvalī
vidyāpravādatah pūrvād grahaśāntirudiritā (Grahasānti Stōtra)

16 Kalpasūtra eighth part Sthavirāvali, Subōdhikā Vrtti

17 समणस्स ण भगवओ महावीरस्स तिन्निसया चउद्दसपुव्वीण अजिणाण जिणसकासाण सव्वक्खरसन्निवाइण जिणो विव अवितह वागरमाणाण उक्कोसिया चउद्दसपुव्वीण समणसपया हुत्था ।

samanassa nam bhagavaō mahāvīrassa tinnisayā cauddasapuvvinam ajinānam jinasankāsānam savvakkharasannivāinam jinō viva avitaham vāgaramānānam ukkōsiyā cauddasapuvvinam samanasampayā hutthā (Śrī Kalpasūtra, Sixth Part sūtra 138)

18 वाणी तिहुअणसामिणी सिरि देवी जक्खराय गणिपिडगा ।
गह दिसिपाल सुरिंदा सयावि रक्खन्तु जिणभत्ते ।।
vāni tihuanasāmini siri dēvi jakkharāya ganipidagā
gaha disipāla surindā sayāvi rakkhantu jinabhattē
(Santikaram Stōtra, Gāthā 4)

19 'Yantra' by Madhu Khanna p 6

20 Ibidem p 116

21 Mantra and Yantra are parallel to each other and in some cases may be interchangeable ('Yantra' by Madhu Khanna p 38)

22 चैतन्यरहिता मन्त्रा प्रोक्ता वर्णास्तु केवलम ।

caitanyarahitā mantrāh, prōktā varnāstu kēvalam

('Agocar Visva' by Davesh Mehta, Gujarat Samachar, 13th Oct 1996, p 6)

23 'Yantra' by Madhu Khanna p 6

24 Mantra Tantra Yantra Mahāsamuccaya (Published by Gajanan Pustakalaya Surat, p 15)

25 Yantra and mantra present the union of archetypal space and sacred sound Each is inseparable from the other Mantra is the soul and yantra is the body of subtle sound ('Yantra' by Madhu Khanna P 44)

26 'MantraVidyā' by Karanidan Sethia 'YantraVidyā' Khand p 18, 19, 20
Mantra tantra yantra Mahāsamuccaya p 320, 321 322

27 'MantraVidyā' - 'YantraVidyā' Khand p 31

28 'Yantra' by Madhu Khanna p 48

29 'Sūrimantra kalpa samuccaya' part-II p 360 361
(Ed Pūjya Muni Śri Jambūvijayaji Mahārāja)

30 करामलकवद विश्व कलयन केवलश्रिया ।

karāmalakavad visvam, kalayan kēvalaśriyā
(Śri SaKalā rhat Stōtra - verse 11 by Śri Hemacandrasūriji)

31 'Yantraraj Śriyantra' by Pankaj Dixit (Swagat Sept 1995 p 52)

32 'Yantra' by Madhu Khanna, p 72 & 74

33 'Yantraraj Sriyantra' by Pankaj Dixit (Swagat, Sept , 1995, p 52, 53)

34 Ibidem, p 53

35 इह नाण-दसणावरण-वेय-मोहाउ-नाम-गोआणि । विग्घं च ॥३८॥

iha nāna-damsanāvarana-vēya-mōhāu-nāma-gōāni
viggham ca 38 (Navatattva, Verse-38)

36 यत प्रज्ञापनाया दश संज्ञा । ताश्चेमा - कइण भते ! सण्णाओ पण्णत्ताओ ? गोयमा ! दस सण्णाओ पण्णत्ताओ त जहा - आहारसण्णा भयसण्णा मेहुणसण्णा, परिग्गहसण्णा कोहसण्णा माणसण्णा मायासण्णा लोहसण्णा ओहसण्णा लोगसण्णा ॥

yatah prajñāpanāyām daśa sañjñāh tāścēmāh - kainam bhantē ! sannāō pannattāō ? gōyamā ! dasa sannāō pannattāō, tam jahā - āhārasannā, bhayasannā, mēhunasannā, pariggahasannā, kōhasannā, mānasannā, māyāsannā, lōhasannā, ōhasannā, lōgasannā

(Ācārāṅga Tīkā First Part, First Chapter, First Sub chapter)

37 दसहा जिआण पाणा इंदिय ५ उसास १ आउ १ बलरुवा ३ ॥

dasahā jiāna pānā imdiya 5 usāsa 1 āu 1 balaruvā 3
(Jiva -vicira prakarana Verse-42)

38 एगिंदिय सुहुमियरा सन्नियर पणिंदिया य सबितिचउ ।
अपज्जत्ता पज्जत्ता कमेण चउद्दस जियट्ठाणा ॥

ēgindiya suhumiyarā, sanniyara panindiyā ya sabiticau
apajjattā pajjattā kamēna cauddasa jiyatthānā (Navatattva, verse-4)

1 Sūksma Aparyāptā ĒKēndriya 2 Sūksma Paryāptā ĒKēndriya 3 Bādara Aparyāptā ĒKēndriya 4 Bādara Paryāptā ĒKēndriya 5 Aparyāptā Dvīndriya 6 Paryāptā Dvindriya 7 Aparyāptā Trindriya 8 Paryāptā Trindriya 9 Aparyāptā Caturindriya 10 Paryāptā Caturindriya 11 Asamjñi Aparyāptā Pañcēndriya 12 Samjñi Aparyāptā Pañcēndriya 13 Asamjñi Paryāptā Pañcēndriya 14 Samjñi Paryāptā Pañcēndriya

These are fourteen types i e species of living beings

18. Two Great Scientists : One From Eastern India And One From Western India

This is what happened long ago, a Professor of Gujarat College of Ahmedabad, happened to go to the intermediate class to give a lecture He looked at the blackboard and loudly read what was written on it "It is trousers that the professor wears " And then, looking at the students, he added," If you wish, I will come from tomorrow onwards without wearing trousers " Hearing this , the class burst into a loud laughter

This plain, simple and straight forward man with interesting nature was none else than the highly intellectual, extraordinary mathematician, Dr P C Vaidya

Recently, at 9-30 a m on October 24, 1995, a rare and unusual astronomical event happened in India It was a total solar eclipse - an event that in the day-light, gave the evening experience The time of the total solar eclipse was at the most only one minute and thirty-eight seconds but the scientists of India and other countries had to make the best use of the little time This renowned mathematician gave guidance about the principles for the experiments to be made during the one and a half minutes

What made Dr Vaidya famous was his research work on Einstein's general theory of relativity Of Indian scientists, only two were directly connected with Einstein for research work One was Dr Satyendranath Bose who was every inch a Bengali and the other was Dr P C Vaidya who besides being every inch a Gujarati, was totally devoted to the Gandhian thought Today we shall talk about research work of two pre-eminent scientists from two ends of India, the eastern end and the western end

Dr Satyendranath Bose

During the period from 1905 A D to 1920 A D , Einstein was renowned as a world famous scientist and scientists all over the world were impressed by his inventive and creative genius Meanwhile, Dr Satyendranath Bose, a Bengali professor of India, came in contact with him Both these scientists

were very fond of music Einstein himself used to play on the violin and Bose was fond of classical music Bose was ambitious to do research work in physics in collaboration with Einstein but this dream of him was never realized Still however, the present-day Bose - Einstein statistics, is a result of his correspondence with Einstein In the correspondence he addressed Einstein as his guru according to the ancient Indian tradition He met Einstein in October 1925 A D Einstein's approval of his research work as a beginner, made Bose famous all over the world Bose was no doubt a great scientist of this century Through his important research works he made revolutionary changes in quantum statistics In 1900 A D Max Planck proposed a new revolutionary hypothesis regarding radiating energy of completely black body lying in a closed container Of course, in his new equation, $E= h\nu$, Max Planck regarded light particles / photons as electromagnetic waves Max Planck(1900), Peter Debye(1910) and Einstein (1917) -- all the three used the classical idea of electromagnetic waves directly or indirectly in explaining the formula for the energy in the radiation from a black body All these three were faced with some kind of difficulties which they had never been able to solve

The first and the most famous of Bose's papers (1924 A D) was a four-page long paper entitled "Planck's law and the light quantum hypothesis" This research paper marks the beginning of the quantum statistics in the modern physics When Bose totally abandoned Planck's wave and aspects of photons and challenged the classical statistical mechanics, he was only 30 years old Bose submitted a paper on this work to the Philosophical Magazine Six months latter, the paper was rejected because of the negative recommendation by the referee On June 4, 1924, Bose then sent the rejected manuscript along with a handwritten cover letter to Einstein in Germany Bose stated in his letter that " I regard the paper as an important contribution and I will have it published " Einstein was very much impressed with the derivation of Max Planck's formula presented by Bose treated photons as particles and not as waves The derivation was totally regardless of the wave form of photons Still however he regarded photon particles as massless Einstein himself translated Bose's research paper into German and got it published in the 1924 August issue of a German magazine To this article Einstein added the following comment " Bose's derivation of Planck's formula appears to me an important step forward The method used here gives also

the quantum theory of an ideal gas, as I shall show elsewhere " Dr S N Bose was the first mathematician to put quantum statistics logically in formulae

$$E(v)dv = \frac{8\pi v^2}{c^3} \bullet \frac{hv}{[\exp(\frac{hv}{KT}) - 1]} \bullet dv$$

This is the world-famous radiation equation of Max Planck At the experimental level, it has been proved fully true In explaining this equation, several scientists accepted radiation in the wave form but in deriving this formula Bose accepted radiation in the form of electromagnetic particles It was his own original achievement

It was a fortunate coincidence that Bose discovered his quantum statistics when de Broglie was developing theory of wave-particle duality of matter Since this discovery was derived from the wave form of particles, it may well be predicted that the Bose would have certainly discovered the wave form of electrons if de Broglie had not done so in 1924

Einstein was the first scientist who fairly well understood Bose's statistics He also used Bose's statistics in the quantum theory of an ideal gases He showed that Bose's statistics is not confined only to photon particles but it also applies to gases and other material particles This statistics developed by Einstein is known ever today in the world of science as Bose-Einstein statistics

In late thirties and early forties of the nineteenth century, Bose participated in the freedom movement of India Bose believed that if knowledge of science and technology is to be disseminated to the common man, it should be imparted through the mother tongue For this purpose he established "Bangiya Bignan Parishad "

In 1962 Bose visited Japan to attend a conference on science and philosophy This conference was held in sad memory of the dropping of the atom-bombs over Hirosima and Nagasaki in August 1945 A D During this visit to Japan, he was very much impressed with scientific, economic, social and cultural progress of Japan From this visit, he got a direct experience of the influence of scientific education imparted through the mother- tongue

After coming to India, he supported compaign for imparting scientific education through the mother-tongue On this point, he shared the same view with Rabindranath Tagore and Svāmi Vivekanand

Recently, two years ago, the birth century of Bose was celebrated and life and works were commemorated and eulogised

Dr P. C Vaidya

Dr Vaidya is a professor of mathematics but his field of research is physics The general theory of relativity is his favourite subject His research work in this field is matchless and rare

When Einstein discovered his Theory of Special Relativity in 1905 A D He was only 26 but, when Dr Vaidya presented his research paper on Einstein's General Theory of Relativity in 1942 A D he was only 24 Recently I happened to see Dr J Krishna Rao, Head of Mathematics Department of Bhavnagar University Dr J Krishna Rao is also a student of Dr P C Vaidya Under the guidance of Dr P C Vaidya, he did his research work from 1961 A D to 1963 A D Dr Vaidya's professor Dr Vishnu Vasudeva Narlikar was his professor, too Since preceding ten years, Dr Narlikar had been pondering on the research work which Dr Vaidya did only in nine months The thought occured to Dr Vaidya and within a week, he completed his research work His research paper was only half page long But in it he solved one of the two problems that had been confusing Einstein

In 1915 A D Einstein gave a new theory of gravitational force In order to determine the definite motion of planets according to the new theory, it was necessary to know the gravitational force of the Sun In the year in which Einstein gave the Relativity Theory i e in 1915 A D , the scientist named Schwarzschild got a solution to Einstein's equations which could determine the gravitational force of the Sun But this solution regarded the Sun as a cool star Naturally, therefore, he had not taken into account light-heat and energy Now the subject for the research suggested by Dr V V Narlikar dealt with finding the solution to Einstein's equations based on the contention that the Sun is a radiating star In the solution given by Schwarzschild treated the Sun as a cool object Naturally, its mass was considered to be constant Since mass was thought to be constant, the calculation was very simple But it was not definite/real Since in Dr Vaidya's research regarded

the Sun as a hot and radiating substance, the mass of the Sun went on changing/decreasing as it went on emitting energy Therefore, there is a slight variation in the gravitational force of the Sun But this variation is very slight and negligible As Dr Vaidya himself stated there is only as much difference as 10^{27} between Schwarzschild's calculation and his calculation While finding a solution every researcher engaged in this research compared the light emitted by the Sun with a liquid and then determined the gravitational force according to Einstein's theory He depended on the prevalent belief that the density of liquid/light is three times as much as the pressure on it But Dr Vaidya discarded the said belief, compared light with flowing water and attached importance only to the velocity of light Dr Narlikar accepted this and they jointly soon arrived at a new equation Later on Dr Vaidya made other equations and found their solutions His research work was thus completed only within a week Really speaking, we can say that a series of research works in his life, began only in this week

Since the calculation made by Dr Vaidya showed only a slight difference, his research was not regarded as very important In 1945 A D , his article showing the details of his solution was sent to Royal Astronomical Society in London for publication in its magazine, it was rejected The solution arrived at in 1942 - 43 A D was ultimately published in the magazine of ' Indian Academy of Sciences' as late as 1951 A D

But after 20 or 22 years, circumstances changed and the research works of Dr Vaidya suddenly assumed importance In the international conference held in Texas in December 1964, this solution given by Dr Vaidya, was discussed as long as two hours Subsequently, his research papers published in 1943- 51- 53 and 1955 A D became very famous The only reason was that quasars were discovered in 1963 A D and pulsars were discovered in 1967 A D Both these types of stars, constellations, emit many times as much radiation as the Sun does Their gravitational force is thousands- millions of times more powerful than that of our Sun The decrease in gravitational force caused by their radiation is, therefore, not negligible The decrease in their gravitational force is hundred thousand times greater than the decrease of the gravitational force in the Sun If it is not taken into consideration, we shall obviously get unreal and deceptive figures showing their position, distance and mass These powerful centers of gravitation must, therefore, be described according to the theory of Einstein and in that case it becomes

necessary to make calculations according to the solution suggested by Dr Vaidya His research contribution is therefore very important in astrophysics

THE EXTERNAL FIELD OF A RADIATING STAR IN GENERAL RELATIVITY

It is well known that the generalization of Schwarzschild's solution corresponding to the external field of a radiating star has not yet been obtained. The internal field describes a mixture of matter and radiation. In the outer field there is the expanding inner zone of pure radiation, with radius r_1 at time t_1 beyond which the empty space is described by Schwarzschild's static solution. The zone of pure radiation is given by

$$ds^2 = -\left(1-\frac{2m}{r}\right)^{-1} dr^2 - r^2(d\theta^2 + \sin^2\theta d\phi^2) + \frac{\dot{m}^2}{f^2}\left(1-\frac{2m}{r}\right) dt^2, \quad (1)$$

$$f(m) = m\left(1-\frac{2m}{r}\right) \quad (2)$$

[As usual an overhead dot denotes a differentiation with regard to t and an overhead dash a differentiation with regard to r $f(m)$ is an arbitrary function of m.]

Since the lines of flow of radiation must be null geodesics the radiation tensor has to be

$$T^{\mu\nu} = \rho v^\mu v^\nu \quad (3)$$

with $$g_{\mu\nu} v^\mu v^\nu = 0 \quad (4)$$

so that $$(\rho v^\mu)_\mu = 0 \text{ and } (v^\mu)_\mu v^\nu = 0 \quad (5)$$

The surviving components of the tensor are given by

$$-T_1^1 = T_4^4 = \frac{m}{4\pi r^2}, T_1^4 = \frac{\dot{m}^2}{4\pi m' r^2}, T_4^1 = -\frac{m}{4\pi r^2} \quad (6)$$

For differentiation along a line of flow we have the operator

$$\frac{d}{d\tau} \equiv e^{-\lambda/2}\frac{\partial}{\partial r} + e^{-\nu/2}\frac{\partial}{\partial t} \quad (7)$$

It is found that the field equations amount to

$$\text{(i) } \frac{dm}{d\tau} = 0, \text{ (ii) } \frac{d}{d\tau}(r^2 e^{-\lambda} T_1^1) = 0,$$
$$\text{(iii) } \frac{d}{d\tau}(r^2 \rho) = 0, \text{ (iv) } \frac{dv^1}{d\tau} = 0. \quad (8)$$

The equation that is most difficult to handle corresponds to $T_4^4 = 0$ But it can be shown to be equivalent to (ii) The equation of continuity then leads to (iii) and (iv) readily Thus, along the lines of flow of radiation m, v^1 and $r^2\rho$ are all conserved. It is worthy of notice that m' is positive while $\dot{m}$ is negative. This as well as the results (6) and (8) are suggested by the Newtonian analogue.

The total energy of matter and radiation is conserved m is the affective mass of the whole system at a point. The value of m at the boundary $r = r_1$ at $t = t_1$ is a constant, M. At time t_1, for all values of r exceeding r_1, the field is given by Schwarzschild's line-element corresponding to the value M Also $\dot{m} = -f(M)$ when $r = r_1$ and $t = t_1$

The new results are (1), (2), (6), (8) Further details and astronomical applications are considered in a paper to be published elsewhere

My thanks are due to Prof V V Narlikar under whose guidance this work was done and who showed me the result 8 (i)

Benares Hindu University,
March 22 1943

P C. VAIDYA

Einstein Infeld and Hoffmann *Annals of Mathematics* 1938 p. 65 Narlikar, V V *Bombay Univ J*, 1939 8, 37

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The Vaidya-metric of Dr Vaidya is very widely used today in astrophysics Of the articles published in science magazines such as General Relativity and Gravitation, Quantum Theory and Gravitation, Physical Review, Physics Today, nearly 20 articles published every year, widely use Vaidya-metric

Showing his gratitude to Dr V V Narlikar, Dr Vaidya writes about his first research paper *"Professor Narlikar wrote only my name as the author of the* article that we wrote to give publicity to this solution Generally, the authorship of an article is attributed to the teacher who suggested the problem and the name of the student is mentioned as the co-author but Narlikar did not do so because the basic idea of finding a solution had occurred to me He, therefore, gave all the credit for finding the solution only to me Today when I think of this I realized that Narlikar very well knew the full importance of the solution that we had found If as the author of the article he had mentioned his name also along with my name, the solution would have been famous by his name and since I was very young at that time to know all this, he could have very easily attributed to his name the solution which is known today as "Vaidya's solution" But he stuck to academic decorum and decided that since the main idea of the solution was Vaidya's the solution should be attributed to Vaidya's name This is academic honesty "

In 1963 A D a scientist named Roy P Kerr found the solution to the problem of determining the field of external gravitational force of 'Black Holes', non-luminous stars moving round Later on, several scientists made attempts to find a solution to the problem of determining the field of gravitational force of luminous stars moving round but they did not succeed

Dr Vaidya had already solved the problem of determining gravitational force of luminous stars by taking into consideration the light / energy emitted by them In 1973 A D Dr Vaidya and Dr Liladhar K Patel, one of his students, found out an original method of determining the gravitational force of rotating stars This method is known as 'Radiation Kerr Metric' This is another important research of Dr Vaidya in the field of relativity and gravitational force

Very many students have done research work in the guidance of Dr Vaidya Till today he has been directly or indirectly associated with world - famous science institutes of India and especially of Gujarat Even today , the scientists of 'Physical Research Laboratory'(PRL),' 'Indian Space Research Organization

(ISRO),' 'Vikram Sarabhai Community Center' etc of Ahmedabad, look upon Dr Vaidya with full respect and regard his opinions as authentic Dr Vaidya has been an honorary member or chairperson of many foreign institutes dealing with relativity, gravitational force and mathematics He has also graced the chair of a good many science conferences

In order to make students take interest in mathematics, he established ' Gujarat Ganit Mandal' Through it, he publishes the magazine, ' Suganitam' Since 33 years 'Gujarat Ganit Mandal' has been regularly publishing 'Suganitam' All the credit for it goes to Dr Vaidya and his nephew Prof Arunbhai Vaidya who is also a mathematician He has also published as many as seven books Frequently, he wrote articles in the magazines Kumar, Buddhiprakash, Navchetan etc The letters that he wrote to his daughters are of such high value that they serve as special articles Even today he regularly writes every week one letter on an average to one or another of his daughters

It is a great fortune of India and especially of Gujarat to have such distinguished mathematician By giving to Dr Vaidya in July, 1993, the Dr Vikram Sarabhai Award for science out of the seven awards meant for the best persons in seven different fields, the Gov of Gujarat has rightly appreciated his services and research contribution

It is a happy coincidence that the Bose-Einstein statistics of Dr Satyendranath Bose and Dr P C Vaidya's research regarding the field of gravitational force of radiating stars substantiates the concept of physics of Jain Philosophy

In February 1991 , a conference about Jain philosophy and modern science was organized by the Jain Centre of Ahmedabad Two important research papers about Jain philosophy and physics were presented in the conference 1 Limitations of Einstein's Special Theory of Relativity--- a paper written by Munishri Nandighoshvijayji and presented by Prof H F Shah, Professor of the famous St Xavier's College of Ahmedabad 2 Jain philosophy and Bose-Einstein statistics' --- a paper written and presented by Prof Parasmal Agrawal (Madhya pradesh)

Bose-Einstein statistics enlightens on particles of ideal gases and photon particles In the whole of the universe, space-units are limited in number and pudgala particles are infinite in number according to the Jain philosophy

How can infinite pudgala particles be occupied in space occupied by limited space-units? And how can infinite paramānus be occupied by a single space-unit? A space-unit can be occupied by only single independent paramānu But in the same single space-unit a congregation of infinite paramānus can be occupied

This theory of physics shown by the Jain philosophy, also applies to the bodyless souls which are free from all the eight kinds of karma particles

Emancipated souls reside in Siddhaśīlā, the rock acting as seat of location at the top of the universe for emancipated souls These emancipated souls are Arūpī (devoid of form) and bodyless Each one of them has his independent existence According to the Jain theory the hight of the emancipated soul is two-third of height that he had at the time of nirvāna i e emancipation Still however, infinite other emancipated souls occupy the space which is occupied by a single emancipated soul Ācāryas commenting on Jain scriptures give an easy and simple explanation for this by giving the example of a lamp's light If a small lamp is lighted in a room, light spreads everywhere in the whole room If twenty or twenty-five or hundreds of lamps are lighted in the same room, light of all the lamps spreads everywhere in the room and on the walls of the room but it does not happened that light of a single lamp falls only on a particular spot

According to Prof P M Agrawal, the condition of infinite paramānus occupying the same space-unit and the condition of infinite souls occupying common space-units, can be explained by Bose-Einstein statistics

Dr P C Vaidya's research also substantiates the pudgala-paramānu theory of Jain philosophy According to his research, the gravitational force of radiating stars or of the Sun is less than that of non-radiating stars of the same mass and volume He has shown these calculations by mathematical equations

According to Jain philosophy, energy is a quality and that which has qualities and modifications is a substance [गुणपर्यायवद् द्रव्यम् gunaparyāyavad dravyam]-- (Tattvārtha Sūtra , Ch 5, Sūtra No 37)] Qualities and modifications belong to substances The pudgala i e matter which has a form, certainly has a mass The rays of light are a matter, not qualities The matter pudgala has a quality in the form of energy When radiating star or

the Sun emits light, really speaking, it is subtle rays or micro particles that are emitted These subtle rays or micro particles also have a mass and they strike against the objects which lie in the field of gravitational force of the luminous object which emits them They slowdown the motion of the object or reduce their attraction towards the star or the Sun Of course, this reduction is very meagre according to the meagre momentum ($p = mv = mc$) of light Dr P C Vaidya has given us the calculation of this negligible reduction But even today the modern physics regard photons to have zero mass

The modern physics believes that according to the excessive gravitational force of the Sun etc and of the stars with a very great mass, the space around it contracts and the path of the objects passing through it, slightly curves Really speaking, according to the Jain philosophical contention, space is a single whole substance, it is non-material and inert and it has no qualities Of course, Naiyāyikas (other ancient tradition) regard sound as a quality of space But the Jain philosophy regards sound as fully material, this can also be proved through modern scientific instruments Therefore, according to the Jain philosophical contention, the gravitational force of no object has any influence at all on the inert space devoid of qualities But its gravitational force influences material object in its gravitational field and if the object, the Sun or a star is radiating, its radiation reduces the gravitational force of the object This reduction proves that the energy emitted by stars or the Sun in the form of light/photons, also has a mass According to Einstein's General Theory of Relativity the apparent change of place caused by the gravitational force of the Sun through solar deflection of a star-light, could be approved during the total solar eclipse This also proves that photons have a mass because only that object is influenced by gravitational force which is material and has, therefore, a mass If light particles have zero mass, according to the equation $F = G\frac{m_1 \bullet m_2}{d^2}$, it is not at all influenced by a strong gravitational force of any kind But as shown above, the effect of the strong gravitational force of the Sun on the light of the star, has been reported in the G T R This proves that the mass of light particles is not zero Of course, this is my own conclusion I cannot say that all will agree to it But I will not be at all surprised if in very near future all scientists agree to this my conclusion

It is a happy coincidence that research contributions of both these Indian scientists in the field of physics thus surprisingly substantiate Jain philosophical contentions

THE EASTERN SPIRITUAL TRADITIONS SHOW THEIR FOLLOWERS VARIOUS WAYS OF GOING BEYOND THE ORDINARY EXPERIENCE OF TIME AND OF FREEING THEMSELVES FROM THE CHAIN OF CAUSE AND EFFECT—FROM THE BONDAGE OF KARMA, AS THE HINDUS AND BUDDHISTS SAY IT HAS THEREFORE BEEN SAID THAT EASTERN MYSTICISM IS A LIBERATION FROM TIME IN A WAY SAME MAY BE SAID OF RELATIVISTIC PHYSICS

FRITJOF CAPRA

19. Why Does Omniscient Tīrthaṅkara Moves About On A Golden Lotus?

Indian culture has two traditions 1 The Śramana tradition and 2 The Brahmin tradition The Brahmin tradition is believed to be more than 5000 years old and its scriptures include the Vedas and the Smrutis The Śramana tradition is of two types 1 The Jain Śramana tradition of Bhagavān Mahāvīra and 2 The Buddhist tradition of Gautama Buddha Though both these traditions are contemporaneous, they are absolutely independent of each other Since they are contemporaneous, there have always between them discussions and disputes over scriptural interpretations Still however, both these traditions are chiefly non-violent The premier founder of the Buddhist tradition was Gautama Buddha himself Bhagavān Mahāvīra, the twenty fourth Tīrthankara in the Jain tradition, which he promulgated It means that twenty three other Tīrthankaras, his equals preceded him Modern historians recognize Bhagavān Pārśvanātha and Arhat Aristanēmi (Nēminātha), the cousin of Śrī Krsna, as great men of pre-historical times Moreover in the Rgvēda, which is regarded as the most ancient scripture of the Brahmin tradition, there is a reference to Bhagavān Rsabhadēva the first Tīrthankara of the Avasarpinīkāla (the descending half of the time cycle) of the Jain tradition This proves that Bhagavān Rsabhadēva and *Jainism are more ancient* than the Vēdas *We are here talking of only the* present group of the twenty four Tīrthankaras In the past there were infinite such groups of twenty four Tīrthankaras and there will be infinite such groups of twenty four Tīrthankaras in future Soon after attaining omniscience, all the Tīrthankaras move about by putting their feet on golden lotus flower [1] This is a special characteristic of every Tīrthankara

What is the reason, why *instead of putting his feet on* earth, the omniscient Tīrthankara puts his feet on golden lotus flowers? There are some who say that Śrī Simandharsvāmi and other Tīrthankaras are renouncers of Samsāra, i e world, of wealth and wife and they are non-acquisitive Why

do they then need a golden throne to sit on and golden flowers to put their feet on?

Jain scriptures do not give any clear explanation about this In reply to this question, some modern thinkers, scholars and Jain monks say that after the omniscient Tīrthankara attains omniscience, his body emits a large quantity of energy The earth cannot bear this large quantity of energy Only gold can bear this quantity of energy That is the reason why soon after Tīrthankara attains omniscience, gods make golden lotus flowers and Tīrthankara either moves about by putting his feet on them, sits on them or sits on the golden throne in Samavasarana and gives sermons At that time also, his feet rest on golden lotus flowers

In this regard, my reverend Gurudev, His Holiness Ācārya Śrī Sūryōdayasūriji says that this is not true nor has it any support of scriptures and since gold is also produced in the earth, it is earth-bodied If earth is not capable of holding the large quantity of energy of the omniscient Tīrthankara, how can gold have that capability? There must, therefore, be some other reason for creating golden lotus flowers

Thinking on the basis of scientific principles, this question can be answered as under Today science has proved that every living being constantly emits such type of energy Scientists know this energy as bio-electromagnetic energy This cannot be seen but it can be perceived Some times great men with their extra sensory powers can see this energy Where there is electric energy, magnetic energy is always there Both these energies are connected with each other Michael Faraday proved this in 1833 A D Where there is electro-magnetic energy, there is electro-magnetic field

Of course we cannot see bio-electromagnetic energy but today with the help of modern scientific instruments, coloured photographs of bioelectromagnetic field can be snatched by Kirlian photography Moreover on the basis of their colours and by detecting their defects, diseases can also be diagnosed In ancient times great men knew this bio-electromagnetic field by the name of aura

Śrī Ashok Kumar Dutt, who is a mechanical engineer in Bharat Heavy Electricals Limited, Noida, (Ghaziabad), can see the aura of men Not only that but he also can know the kinds of thoughts of men on the basis of its colours

The effect of a disease comes to the aura three months before the disease enters the body By examining photographs of aura, taken by Kirlian photography, one can know disease, cure it, prevent it from entering the body and remain healthy Of course, the disease enters in the vital body in a minute form but it does not appear in a gross form in the physical body

In short, bio-electromagnetic energy is a scientifically proved fact and there is no doubt about it

It is that every living being emits energy But the kind and quality of it depends on the physical, mental and spiritual development of the living being It also depends on the extent to which auspicious and inauspicious karma particles attached to the soul and karma particles covering the original property of the soul, are cast off All these factors – parameters exist in omniscient Tīrthankara Paramātmā to the highest extent Their bio-electromagnetic energy is therefore, of the excellent quality and the greatest quantity This can be explained by mathematical formulae as under

1 Bio-electromagnetic energy (BEME)α physical state x mental state

2 BEMEα spiritual level x AKFAK

where AKFAK is auspicious karma related to the four aghātī

(not affecting soul-properties) karma

3 BEME α 1/(IKFAK)(FGK)

Where IKFAK is inauspicious karma related to the four aghātī karma and FGK is four ghātī (affecting soul-properties) karma

The sign of variable (α) used in these equations is not without significance It is used here only to show that in no circumstances the bio-electromagnetic energy of a soul is reduced to zero

According to the Jain philosophical tradition, of the three kinds of activities namely, mental, vocal and physical, every soul can do at least one kind of activities i e activities of body, even if the soul belongs to the lowest and most primitive stage

According to the Jain tradition, only sañjñī (possessing mind) womb born five sensed animals (elephants, cows, horses and such other animals,

sparrow, mynas, cuckoos and such birds, fish and other acquatic animals) and gods, hellish beings and sañjñī human beings can do activities of mind The one sensed, i e earth-bodied, water-bodied, fire-bodied, wind-bodied and plant, the two-sensed, the three-sensed, the four-sensed and asañjñī beasts, birds etc and sammūrcchima human beings do not have material mind and therefore, auspicious and inauspicious karma particles do not bind them through mind activities and therefore their bio-electromagnetic energy does not increase or decrease for such cause But since they have a body which is bound by auspicious and inauspicious karma particles, their bio-electromagnetic energy increases or decreases through body-activities Because living beings bound by karma particles, this element is never reduced to zero

Similarly, to whatever state, a samsārī soul may belong to primitive stage, his spiritual energy is never reduced to zero Even in the souls of the most primitive state (nigōda), auspicious variety of nāma-karma, vēdanīya-karma, āyusya-karma and gōtra-karma and especially of nāma-karma and vēdanīya-karma, is never reduced to zero Contrarily, no amount of inauspicious variety of these four kinds of karma particles accumulated together can fully cover the infinite energy of the soul Similarly, no amount of the four kinds of ghati-karma namely jñānāvaranīya, darśanāvaranīya, mōhanīya and antarāya karma particles accumulated together can fully cover the infinite energy of the soul

The sign of variable is used in the equations given above, in order to show that in the whole of the living world, the bio-electromagnetic energy even in the most primitive state of the soul, is never reduced to zero

According to the rule of mathematics, when the sign (=) (equal to) is used in the above equations, 'k' (a constant number) is placed We can call this constant number, a universal co-efficient Of course, this constant number is unknown to nescient beings like us Only the omniscient great men can show its precise value We can now only imagine it as a constant number

The omniscient Tīrthankaras have the following types of characteristics

1 They have the highest physical powers because they have the superior type of bone-construction namely, Vajrarsabhanārāca, which is ca-

pable of tolerating the greatest discomforts and harassments Even if the Kāla-cakra is thrown on their head, they do not die

2 Since they have the greatest physical strength, they have the greatest mental strength because only a sound body can have a sound mind (mana) That is the reason why men in Vajrarsabhanārāca cannot be diverted from dhyāna, i e meditation even by gods

3 Dhyāna is concentration of mind, speech and body Therefore, they have a strong body and strong mind, can have superior type of dhyāna/ meditation and a superior type of spiritual state

4 The greater the rise of auspicious karma of a soul, the greater the bio-electromagnetic energy Tīrthankaras have the best and most distinctly meritorious Tīrthankara nāma-karma accumulated by them in the penultimate (immediately preceding the last) birth by virtue of their auspicious acts and auspicious thoughts That karma and karmas related to it very strongly come into rise and therefore, they have the most powerful bio-electromagnetic energy

5 Since they are Tīrthankaras, perhaps no inauspicious karma come into rise and therefore their related karmas raise no obstacles to their bio-electromagnetic energy

6 There are chiefly four types of karma that veil and obstruct the infinite qualities of the soul namely, (1) knowledge obscuring (2) darśana obscuring, (3) infatuating and (4) obstructing karmas The omniscient souls are perfectly free from these karmas They, therefore, experience the infinite qualities and energy of soul

In all the six ways shown above, the greatest/ highest energy of the omniscient Tīrthankara manifests in the largest quantity This energy is in the form of subtle bio-electromagnetic energy It is believed that since the earth cannot bear the burden of this highest energy, Tīrthankara walks by putting his feet on the golden lotus But this is not the fact This energy tremendously energizes the atmosphere Human beings and other animals can not catch this energy If at all they do so, they are probably harmed rather than helped In order to enable men to make the best use of the greatest energy of Tīrthankara for a long time, gods create golden lotus flowers to pull down into the earth, the superior type of bio-electromag

netic energy of the Tīrthankara and Tīrthankara walks by putting his feet on the golden lotus flowers

We generally see that a copper wire is set high on a sky-scapper and another end of the wire is set down under the ground The reason is that the wire absorbs the high electrical charge in the atmosphere of the rainy season and takes it down into the earth The lightening, therefore, does not fall anywhere about the place It is my contention that gods create golden lotus flowers only in view of this principle because gold is very sensitive and highly conductive to electricity and it is more conductive than copper Tīrthankara's energy, therefore, passes down into the earth through golden lotus flowers As a result, wherever Tīrthankara wanders about or wherever he has wandered about and left, for six months and within certain area, a natural calamity such as epidemic or a famine does not come nor there is an excessive rain-fall or absence of rain nor there is harrassment from mosquitoes, flies, butterflies, locusts and other insects and creatures Moreover inauspicious activities of human beings and animals in that region are probably removed [2]

Mahāvīrasvāmi lived more than 2500 years ago But in Magadhas land of his wanderings, i e Bihar of today, places of his Kalyānakas, especially places of attainment of omniscience, the bank of the river Ṛjuvālikā and the place of nirvāna kalyānaka i e final emancipation Pāvāpurī even today give delightful and divine experiences to holy men

Thus Tīrthankara does good to the whole world

This is the excellent result of Tīrthankara's excellent aspirations

References 1 यत्र पादौ पद धत्तस्तव तत्र सुरासुरा ।
किरन्ति पङकजव्याजात श्रिय पङकजवासिनीम ।।
yatra pādau padam dhattastava tatra surāsurāh
kiranti pankajavyājāt sriyam pankajavāsinim

(Vitarāgastōtra, Fourth Chapter Verse No 3)

2 Vitarāgastōtra Third Chapter, verses No 4 to 10)

20. Kinds Of Jāpa And Their Scientific Importance

पूजाकोटिसमं स्तोत्रं स्तोत्रकोटिसमो जपः । जपकोटिसमं ध्यानं, ध्यानकोटिसमो लयः ।।

pūjākōtisamam stōtram, stōtrakōtisamō japah

japakōtisamam dhyānam, dhyānakōtisamō layah [1]

A Stōtrapātha or Stutipātha (recitation of a song and praise i e prayer) of vītarāga paramātmā or any other god, gods and goddesses etc is worth his worship performed a crore times A Jāpa is worth a Stōtra (praise) recited a crore times A meditation is worth a Jāpa muttered a crore times An absorption, delight in the form of Paramātmā or unification of one who performs meditation, meditation and the object of the meditation is worth a meditation performed a crore times

Here worship generally means worship of idol of a god or a goddess performed with the best meterials of worship It is of various kinds Astaprakārī (with eight types), Pañcaprakārī (with five types), Ēkōpacārī (with single type), Ēkavimśatiprakārī (with twenty-one types) and Bahuvidhaprakārī (with various types) The materials and means of worship are chiefly important in this worship Here the activities are mainly of the body A Stōtra i e praise recited once is worth a Pūjā performed a crore times If complete concentration of mind, speech and body is attained while performing Pūjā of the Dēvādhidēva Paramātmā, the great God and if the mind indulges in auspicious thought processes i e meditation, one can also attain omniscience while performing Pūjā e g Worship with flowers performed by Nāgakētu Similarly, recitation of Stuti or Stōtra (song of praise) chiefly involves the activities of speech and body while the activities of mind or sensorium are subordinate A Jāpa is worth a Stōtra recited a crore times A Jāpa mainly involves the activities of mind or sensorium There is probably no activity of speech or body According to the saying-"mana ēva manusyānām kāranam bandhamōkṣayōh " (मन एव मनुष्याणां कारणं बन्धमोक्षयोः ।) when the mind receds from inauspicious activities and engages in auspicious activities such as Jāpa

etc the inflow of inauspicious karma come to stop and there is an accumulation of auspicious karma and thus proceeding further he who performs Jāpa indulges in meditation Therefore, a one-time meditation is worth a Jāpa muttered a crore times He who engages in meditation, the meditation, the object of meditation and himself - all these are separate Only the concentration of mind, speech and body is important When the object of meditation, *meditation and the meditator* [2] *-- all these three -- are unified in the form of* Paramātmā (the super soul) or the soul, he attains the stage of absorption and such an absorption is worth meditation of crore times

According to the above verse, worship, Stuti or Stōtra (song of praise), Jāpa, meditation and absoption i e unification are gradually ascending power Jāpa is of three kinds 1 spoken Jāpa 2 speechless Jāpa and 3 mental Jāpa

1 Jāpa muttered with loud pronunciation so that others can hear, is called a spoken Jāpa (Bhāsya)

2 Jāpa muttered mentally by making a flapping sound so that others cannot hear, is called speechless Jāpa (Upāmśu)

3 Jāpa muttered mentally without using lips, tongue etc called mental Jāpa (Mānasa)

Upādhyāya Śrī Mānavijayajī states in the book entitled 'Dharmasangraha'

" ....सशब्दान्मौनवान् शुभ । मौनजान्मानस श्रेष्ठ जाप श्लाघ्य पर पर ।। "

saśabdānmaunavān śubhah

maunajānmānasah śrēsthah jāpah ślāghyah parah parah

[Speechless Jāpa is better than the spoken one and mental (Mānasa) Jāpa is superior to speechless Jāpa All these three varities of Jāpa are gradually more praise worthy]

Pratisthāpaddhati (kalpa) written by Śrī Pādaliptasūrijī states that there are three kinds of Jāpa Mānasa (mental), Upāmśu (speechless) and Bhāsya (spoken)

Jāpa which does not involve even a low utterance, which is muttered in mind and which only its mutterer can understand, is called Mānasa (mental) Jāpa Jāpa which involves low utterance and which others cannot hear is

called Upāmśu (speechless) Jāpa Jāpa which others can hear is Bhāṣya (spoken) Jāpa Mānasa (mental) Jāpa is difficult to perform It is performed for doing works of peace It is, therefore, the best Upāmśu (speechless) Jāpa is performed for common welfare It is a common kind of Jāpa Bhāsya (spoken) Jāpa is easy to perform It is generally performed for doing such wicked acts as subduing or fascinating others It is, therefore, bad [4]

In the modern physics, the scientists named de- Broglie states in his particle- wave theory of material particle that subtle particles behave like waves and the formula of wave-length of waves pertaining to the particles is

$\lambda = \frac{h}{mv}$, where l is wave-length, h is Planck's constant, m is mass of the particle and v is velocity of particle [5] In this formula, if $mv = p$, then $l = h/p$, where p is momentum The formula of energy of particle of matter is $E= nhf$, where E is enrgy, h is Planck's constant, f is frequency and n stands for integer numbers i e $n= 1, 2, 3, 4, 5,$ etc [6] The energy of particles of a matter which are in the form of wave, depends upon its frequency and the frequency varies inversely with the wave-length If the wave-length increases, the frequency decreases and the wave-length decreases, the frequency increases The wave-length inversely varies with the product of the mass of the material particle and its velocity If there is an increase either in mass or velocity or in both of a subtle material particle the wave-length of the material particle decreases proportionately And, therefore, frequency and consequently energy increases This rule can be applied to the kinds of Jāpa shown by our sages

According to the Jain scriptures, there are eight types of Varganās (grouping of physical material particles i e paramānus) Varganā is a technical word of Jain scriptures Varganā is a kind of unit of a constituent paramānus i e particles The first Varganā means separate - single particles i e paramānus spread all over the universe The second Varganā means groups of units of two paramānus each The third Varganā means units of groups of three paramānus each The fourth Varganā means units of groups of four paramānus each Thus there are infinite kinds of units of paramānus But the following eight types of Varganās are useful to living beings -

1 Audārika Varganā, 2 Vaikriya Varganā 3 Āhāraka Varganā, 4 Taijas Varganā, 5 Bhāsā Varganā, 6 Śvāsōcchvāsa Varganā, 7 Manō Varganā, 8 Kārmana Varganā

Every constituent unit of all these Varganās have infinite particles i e paramānus and yet a constituent unit of a Vaikriya Varganā has a larger number of paramānus than the number of paramānus of the unit of Audārika Varganā and a constituent unit of Āhāraka Varganā has a still greater number of paramānus than the number of paramānus of the unit of the Vaikriya Varganā Similarly, a constituent unit of each subsequent Varganā has a gradually increasing number of paramānus And with increasing number of paramānus in the unit of each Varganā, the size of paramānus becomes gradually subtler and subtler As a result a constituent unit of Manō Varganā has a greater number of paramānus than a constituent unit of Bhāṣā Varganā [7]

It should be remembered here that Jain Āgamas were written in a fifth or sixth century of Vikram Era Till then it was customary for monks and nuns of Jain tradition to commit Āgamas to memory While the quantum mechanics of modern physics was invented as late as at the end of the 20th century of Vikram Era

According to the modern physics, the velocity of sound i e constituent units of Bhāsā Varganā is only 330 metres / second, but the speed of constituent units of taijas Varganā i e electromagnetic waves, light waves waves of radio and television is 30 crore metres /sec That is why the constituent units of Bhāsā Varganā have les energy, though they have a far greater number of paramānus than the constituent units of taijas Varganā The constituent units of Manō Varganā have a very large number of particles (paramānus) that gets tranformed as thoughts or mind and they are very subtle, too As we experience in our daily life, the speed of mind and its thought- pudgalas is tremendous Therefore, their energy is infinite or very high

Of the three kinds of Jāpa taught by spiritual sages, the first spoken Jāpa uses the constituent units of paramānus of Bhāsā Varganā Since their speed is very slow, their frequency is low and as a result their energy is very small In that kind of Jāpa, therefore, the message takes time to reach the

presiding deity Its intensity is also very low

The second kind of Jāpa namely speechles Jāpa, uses the constituent units of *paramānus* of Bhāsā Varganā *and its speed is 330metres / sec* Still however this kind of Jāpa produces inaudible sound waves Generally, we can hear sound waves only of a certain frequency Sound waves having frequency 20 to 20,000 are audible Sound waves having more frequency than 20,000, cannot be grasped by the ear Therefore, ultrasonic waves of a high frequency produced in speechless Jāpa have a considerable energy [6] That is why speechless Jāpa is better than spoken Jāpa

Mānasa Jāpa is the best of all It has only the constituent units of paramānus of Manō Varganā It has the largest number of particles and its velocity is also highest Since the waves produced by mānasa (mental) Jāpa have the highest frequency, their energy canot be imagined Since the waves of Mānasa Jāpa have a far greater velocity and a far larger number of paramānus than the electromagnetic waves of taijas Varganā, they have infinite energy Really speaking, *this Jāpa does not at all use speech It is, therefore, also* called ajapā-Jāpa, a Jāpa without utterance and it is natural and auotmatic Only the mind is used in this Jāpa

In conclusion, I pray, "May all living beings fulfil their desires through mānasa Jāpa, engage in meditation of the Dēvādhidēva i e great God and ultimately attain eternal bliss

References

1 Dharmasangraha part 1 Gujarati Translation p 347

2 ध्याता ध्येय तथा ध्यान त्रयमेकात्मता गतम । इति ते योगमाहात्म्य कथ श्रद्धीयता परै ॥
dhyātā dhyēyam tathā dhyānam trayamēkātmatām gatam
iti tē yōgamāhātmyam katham śraddhiyatām paraih
(Vitarāgastōtra, prakāśa-14)

3 Dharmasangraha part 1 Gujarati Translation p 346

4 Ibidem

5 Quantum Mechanics by P M Mathews & K Venkatesan p 2

6 Ibdem p 7

7 Detailed information of these *Varganās* is given in the commentary of Sri Ācārāngasūtra, The Pañcasangraha The Karma-Prakrti Readers may read it in

these books

8 With the help of the ultrasonic waves a urine stone is broken into powder and forced out of the body without a surgical operation and sometime a thrombous in the body is melted This speaks of the energy of these inaudible ultrasonic sound waves

THEY REALIZE THAT GOOD AND BAD, PLEASURE AND PAIN, LIFE AND DEATH, ARE NOT ABSOLUTE EXPERIENCES BELONGING TO DIFFERENT CATEGORIES, BUT ARE MERELY TWO SIDES OF THE SAME REALITY, EXTREME PARTS OF A SINGLE WHOLE THE AWARENESS THAT ALL OPPOSITES ARE POLAR, AND THUS A UNITY, IS SEEN AS ONE OF THE HIGHEST AIMS OF MAN IN THE SPIRITUAL TRADITIONS OF THE EAST

FRTJOF CAPRA

21. Scientific Importance Of Guru In The Spirituality

ध्यानमूलं गुरोर्मूर्त्ति, पूजामूल गुरो पदौ ।। मन्त्रमूलं गुरोर्वाक्यं मोक्षमूलं गुरो कृपा ।।

dhyānamūlam gurōrmūrttıh, pūjāmūlam gurōh padau
mantramūlam gurōrvākyam, mōksamūlam gurōh krpā

The centre of meditation is guru's idol The place of worship is at guru's feet Guru's word is the source of mantra Guru's blessings results in 'mōksa' i e final liberation

No other western tradition holds guru in a such high esteem as the Indian spiritual tradition In Indian spiritual tradition, there are three chief elements– God, guru and dharma (religion) God and guru are living entities and dharma is a conceptual entity of qualities The basic difference between God and guru is that the previous status of God is that of guru and then he attains the status of the great God To attain the eternal bliss i e liberation from the bondage of karma is our ultimate aim It is the guru who introduces to us the concepts of God and dharma Showing the importance of guru, Kabīrajī says

गुरु गोविंद दोनो खडे, किसको लागु पाय । बलिहारी गुरु आपकी गोविंद दियो बताय ।।

guru gōvinda dōnōm khadē, kisakō lāgu pāya
balihārı guru āpakī, gōvinda diyō batāya

Guru has not yet attained perfect Godhood but he has started his journey on the path of attaining Godhood His knowledge of the right path and experience offers guidance to every aspirant And without a guide, none can attain the highest state and experience of self-realisation That is why in Indian spirituality, guru is regarded not only indispensable but extremely inevitable

It is said

गुरु देवो, गुरु देवता गुरु विण घोर अंधार । जे नर गुरुथी वेगला, रडवडिया संसार ।।

guru dēvō, guru dēvatā, guru vina ghōra amdhāra
jē nara guruthī vēgalā, radavadiyā samsāra

[Guru is the lamp, guru is God, and without guru there is dreadful darkness Those who are far from guru, wander badly in Samsāra i e birth and death cycle]

It was not without reasons that our ancient sages gave so much importance to guru They were erudite and they also had knowledge from experience Whatever they attained, they attained only through the blessings of their guru They directly experienced and saw that those who had not acquired guru's blessings wandered here and there in Samsāra in spite of being very capable and learned Therefore, the importance that they gave to *guru is justified and also from the viewpoint of modern science, it is proper*

Every living being gross or subtle, has a sort of energy In spiritual terminology, it is called spiritual power but in scientific terminology, it is called electromagnetic energy that depends upon the spiritual evolution of soul The more purity of the soul, the more manifest the energy

A scientific magazine entitled 'New Scientist' has published the results of certain experiments Accordingly, there is a magnetic compass in the human body Though unknowingly, we can come under the influence of a magnetic field

Those who know even elementary science, know that around a magnet, there is its own magnetic field and it is represented by magnetic lines The magnetic field is invisible but if you put a magnet on a piece of paper on a table, spread a few iron particles around it and pat the table with your finger, the iron particles will automatically be arranged along the magnetic lines in the magnetic field If a piece of iron comes in the magnetic field, the magnet attracts it If changes are often made in the magnetic field, an electric current is produced and if this electric current is passed through metal wires etc magnetic energy or magnetic field is produced in them Thus electric energy and magnetic energy are interdependent or co-related When both these energies combine, electro-magnetic energy is produced This sort of energy is there in living beings also but it is subtler and more powerful The laws of gross electromagnetic energy and its field also apply to bio-electromagnetic field and energy If one magnet is brought into the magnetic

field of another magnet, like poles repel and unlike poles attract A magnet influences another magnet or an object in its magnetic field Similarly, thoughts of a living being influence the thoughts of other living beings nearby Around every living being, there is an electromagnetic field It is called an aura (abhamandal) With the help of Kirlian photography, this aura can be photographed That is why our ancient sages said

चित्रं वटतरोर्मूले, वृद्धा शिष्या गुरुर्युवा । गुरोस्तु मौन व्याख्यान, शिष्यास्तु छिन्नसशया ।।

citram vatatarōrmūlē, vrddhāh sisyā gururyuvā
gurōstu maunam vyākhyānam, sisyāstu chinnasamsayāh

[It is a surprise that among the ascetic monks sitting under the banyan tree, the disciples are old and the guru is young and it is a greater surprise that the guru's lecture is his silence which removes the doubts of the disciples]

Thus, a mere company of a spiritually accomplished guru inspires spiritual development of his disciples

In different sects of Indian spiritual tradition, the guru imparts blessings to his disciples in different ways A blessing is a sort of transmission of energy Generally the disciple who seeks blessings, bows at the feet of the guru and holds guru's feet who offers blessings Then the guru lays his hand on the disciple's head and blesses him During this process the electric current emitting from the guru's hand passes through the disciple's head to his hands and as his hands touch the guru's feet, it passes into the guru's body Thus as the electric circuit is completed, guru's energy passes into the disciple In another tradition, the guru smells the disciples head There also such a transmission of energy takes place

In the Jain tradition, Śramana Bhagavān Mahāvīra was the twenty fourth Tīrthankara and his first disciple was Srī Gautamasvāmi [1] Their master-disciple relation was famous His original name was Indrabhūti and Gautama was the name of his family (Gōtra) But as great men are now-a-days known by their surname, sages of ancient times were known by the name of their Gōtra He was therefore, known in the Jain tradition as Gautamasvāmi and today also he is worshipped by the same name As stated in Jain religious scriptures, when Mahāvīrasvāmi was 42 years old and Indrabhūti Gautama was 50 years old, they met each other Prior to their meeting, he

was a Brahmin pundita well-versed in 14 Vidyās i e 14 different branches of ancient literature, and he used to perform sacrificial rite He had 500 Brahmin disciples So long as Indrabhūti Gautama had not seen Bhagavān Mahāvīra and had not entered in his spiritual bio-electromagnetic field, he cherished the ambition to conquer Bhagavān Mahāvīra in debate and establish his supremacy in all branches of literature all over the world But as soon as he came near Samavasarana, a place of sermon, where Bhagavān Mahāvīra was sitting and saw him, his ambition to defeat Bhagavān Mahāvīra crumbled and he lost himself in the surrender to Bhagavān Mahāvīra and thus justified the statement that a guru's idol is a centre of meditation "ध्यानमूलं गुरोर्मूर्त्ति । *dhyānamūlam gurōrmūrttih*"

It is said that when Tīrthankara Paramātmā gives religious sermon, people, birds, and beasts from a distance of as many as 12 Yōjanas (1 Yōjana= 8 miles) come to hear his sermon His spiritual bio-electromagnetic field expands as far as twelve Yōjanas

Now- a -days as the techniques of acupuncture, acupressure and colour therapy are used to cure physical diseases, so magnetotherapy is also used This is what follows from the description of the state of omniscience of Sramana Bhagavān Mahāvīra, the Guru of the whole universe His bio-electromagnetic field was so powerful that wherever he went, people of that region were cured of their diseases and nobody fell ill as long as six months after his departure Enmity could not prevail No famine was caused by absence of rain or excessive rainfall That was the effect of his grand power It seemed as if he had hypnotised or mesmerised all

Really speaking, it will not be surprising if western scientists prove in near future that all these excellences or unexplained properties (Atiśayas) of a Tīrthankara's life were not miracles but they were the effects of the pure bio-electromagnetic field of their spiritual power that was revealed on removal of karmic obscurities of his soul When Indrabhūti Gautama got from Bhagavān Mahāvīrasvāmi the explanation which solved his doubt about the existence of soul, he accepted Bhagavān Mahāvīra as his guru, devoted his life to him and justified that a guru's feet are a place of worship- 'पूजामूलं गुरोः पदौ । *pūjāmūlam gurōh padau* "

And when Śramana Bhagavān Mahāvīra gave Dīksā (initiation) to his

eleven Ganadharas (prime disciples) namely Indrabhūti Gautama etc by sprinkling the fragrant powder on their head from the golden dish held by Indra, lord of the first heaven Through his blessings he transmitted a part of the light of his omniscience to his disciples With that knowledge they composed the complete Angasūtras (main scriptures) and fourteen Pūrvas (sub scriptures) out of only three sentences (which are known in the Jain terminology as Tripadī) told by lord Mahāvīra - (1) Uppannē I Vā, (2) Vigamē I Vā , (3)Dhuvē I Va Thus guru's words in the form of three sentences became mantras Thus it is justified that guru's sentence is the source of Mantra "मन्त्रमूलं गुरोर्वाक्य I *mantramūlam gurōrvākyam"*

For thirty years after initiation, Ganadhara Śrī Gautamasvāmi served and worshipped Śramana Bhagavān Mahāvīra As a result he attained extra ordinary powers (labdhis) That is why his name is preceded by the well deserved epithet - 'Ananta-Labdhi-Nidhāna' Yet he did not attain omniscience The only reason for it was his attachment to Śramana Bhagavān Mahāvīra On the night of his nirvāna i e liberation, lord Mahāvīra sent Śrī Indrabhūti Gautama to give sermon to Brahmin Dēvaśarmā who lived in the village nearby Mahāvīra did so in order to ward off Gautama's attachment towards him While he was returning after giving sermon to Brahmin Dēvaśarmā , Śrī Gautamasvāmi became disturbed and agitated on hearing, on the way the news of nirvāna of Śrī Mahāvīrasvāmi Detachment grew out of the pain of separation from guru and when the tie of attachment towards Śrī Mahāvīrasvāmi was broken, he attained omniscience Thus it is justified in the life of Śrī Gautamasvāmi that guru's blessings results in 'mōksa' i e final liberation- "मोक्षमूलं गुरो कृपा I *mōksamūlam gurōh krpā* "

In short, the importance that is given to a guru in the Indian spirituality is fully upheld by scientific principles One need not doubt it at all This article, too is a fruit of words and grace of my Rev Gurudēva Ācāryaśrīvijaya Sūrōdayasūriji Mahārāja

References

1 *This Gautamasvāmi is different from Gautama Buddha of the Buddhist* religion and the Gautama Rsi of the Nyāya-Vaisēsika darśana

2 A description of the Gautamsvāmi's mental struggle at that time is found

in Jain religious scriptures namely, the commentary on the Kalpasūtra , the com mentary on the Āvaśyakasūtra etc

> TO THE ENLIGHTENED MAN WHOSE CONSCIOUSNESS EMBRACES THE UNIVERSE TO HIM THE UNIVERSE BECOMES HIS 'BODY' WHILE HIS PHYSICAL BODY BECOMES A MANIFESTATION OF THE UNIVERSAL MIND, HIS INNER VISION AND EXPRESSION OF THE HIGHEST REALITY, AND HIS SPEECH AN EXPRESSION OF ETERNAL TRUTH AND MANTRIC POWER
>
> LAME ANAGARIKA GOVIND, *FOUNDATIONS OF TIBETAN MYSTICISM* P 225

22. Light : Animate Or Inanimate?

Śramana Bhagavān Mahāvīra lived more than 2500 years ago but his dispensation prevails even today He has pretty well explained in his sermons the nature of the material world that he saw through omniscience and even today the doctrines expounded by Bhagavān Mahāvīra is passing the tests of science

It must be admitted that Jain scriptures have made an incomparable contribution in the field of biology

According to the Jain philosophical tradition, besides animals and plants, earth, water, fire and wind have life Today, it is very necessary to prove not only on the basis of logic but practically in scientific ways that there is an element of life in all these This is an urgent demand of the day and it is our responsibility to satisfy the demand

Since last few centuries, some wrong beliefs about light have become popular in the Jain society and especially among monks and nuns These popular beliefs have no strong support of Jain canonical scriptures Generally there are no lamps in Upāśrayas i e places of Jain monks and nuns The Jain monks and nuns do not use lamps because it is very necessary for them to observe non-violence and according to Jain philosophical belief fire also has life

Now-a-days there is a custom among Svētāmbara idolatrous Jain monks that whenever one wishes to go through the light of a lamp one should go wrapped in a woollen cloth The reason for this custom is that light is fire-bodies i e it is living being and as soon as it touches our body, it dies A woollen cloth should therefore be wrapped around the body in order to save the living beings of light of electric lamps, candle-sticks from falling on it The light of the Sun the moon, the planets, the constellations and the stars is regarded to be lifeless

On the other hand, lots of researches are now-a-days done in science and these researches inspire some people to believe that the light of lamps of

electricity and of lamps of ghee, oil kerosene etc is lifeless It is, therefore, very necessary to know the real nature of light on the basis of Jain scriptures

According to Jain scriptures there are chiefly six kinds of the Pudgala Dravya (matter) 1 subtle-subtle, 2 subtle, 3 subtle-gross, 4 gross-subtle, 5 gross, 6 gross-gross The commentary of the Jain canonical treatise of Śrī Daśavaikālikasūtra written by Rev Ācārya Śrī Haribhadrasūriji Mahārāja states on the authority of the Jīvābhigamasūtra that every separate unit of a Pudgala Dravya i e matter, or paramānu/atom of the matter belongs to the class of the subtle-subtle, pudgala aggregates (skandhas) of two units of matter i e paramānus to aggregates of infinite units of matter belong to the class of the subtle, pudgala aggregates of smell (good and bad) belong to the class of the subtle-gross, wind-bodies belong to the class of the gross-subtle, water-bodies belong to the class of the gross, fire-bodies, plant-bodies earth-bodies and moving beings such as the two-sensed, three-sensed etc belong to the class of the gross-gross In the commentary on the Tattvārthasūtra Śrī Siddhasēna Gani, also shows that wind-bodies are subtler than fire bodies The reason that he gives for this is that fire-bodies can be directly seen but wind-bodies cannot be directly seen

On the other hand modern science clearly states that particles of light called photons are subtle like electrons but gases such as hydrogen oxygen etc are grosser than them because a hydrogen atom has one electron one proton and one oxygen atom has 8 electrons, 8 protons and 8 neutrons and each gas contains pairs of atoms which are called molecules in the terminology of science From this point of view light particles should not be considered as fire-bodies i e living being but fire-producing substances, their flames etc should themselves be regarded as fire-bodies i e living beings When electricity is passed into an electric lamp, the filament of the tungston metal gets heated and emits light Fire is produced in it and it is regarded to be a live filament Similarly, only burning live-coals, flames of fire, lightning in the sky and fire particles covered with ashes are called fire-bodies but the light coming out of them cannot be called fire-bodied In this context the prakrit commentary of the fourth uddēśaka of the first chapter (adhyayana) of part I (first śrutaskandha) of the Jain canonical treatise named Ācārāngasūtra states only five types of gross fire-bodies (1) burning live coals etc (2) fire (3) flames detached from the source (4) flames attached to the burning object (5) fire particles covered with ashes in the furnace

Nowhere is light shown here to have life but light and its hot touch are shown as characteristics of life in fire i e source of light In this context the author of a niryukti (prakrit commentary in verses) of the Ācārāngasūtra, gives the illustration of a glow-worm He says that the glow-worm emits light only while it has life but after death it cannot emit light and, therefore, its light is a characteristic of its life Similarly fire-bodies can emit light only while they have life and only the body of living animals or human beings is hot and after their death it becomes cold Fire has a hot touch only because it has life The hot touch proves that fire bodies have life The light coming out of fire should, therefore, not be believed to have life

Well-versed in ten Pūrvas (the Jain canonical scriptures) Śrī Śayyambhavasūrijī Mahārāja states in the Daśavaikālikasūtra that monks and nuns should not burn or cause to burn common fire, pieces of charcoal, dung-fire, lamp-fire, flames, pieces of live-coal, pure-fire, electricity, firebrands etc , nor sprinkle it with a fuel of ghee etc nor touch it, nor mix to different kinds of fire, nor to enkindle it by fanning etc i e nor to enlarge them, nor to extinguish it nor cause or encourage some-one to do all this

This means that he who does all this commits the sin through violence of fire-bodies

Nowhere it is stated here that if the light emitted by fire-bodies falls on the body of a monk or a nun, the firebodies are hurt If fire or a lamp is burning, a monk cannot have it extinguished If the light of a lamp contained life and if it died by falling on the body of monk or nun, omniscient or canonical scriptures would fully allow the monks and nuns to teach to extinguish lamps for observance of non-violence or would clearly teach to keep away from such places This shows that fire from which light and heat emerge or emit, contains life and that is why who extinguishes or teaches to extinguish fire-bodies commits the sin through their violence Since light does not contain life, so if light falls on the body of a monk or a nun, he does not commit the sin through violence of fire bodies

As stated above, nowhere in Āgamic (canonical) literature is light stated to have life It means that it is non-living It is, therefore necessary to think when and how the tradition of believing that light has life, originated First of all references of this are found in religious scriptures of Śvētāmbara idolatrous

tradition of tapagaccha, dealing with literature of failure of conduct of monks, nuns and lay-persons and in the Sēnapraśna

Both the texts (references) are as under

1 If the lightning and light of lamps touch the body of man, it causes a failure-of-conduct

2 (1) Question If lightning touches the body of man while he is performing the ritual of Pratikramana in the rainy season, does it cause a failure-of-conduct (Aticāra)?

Answer It has been heard from Rev Śrīvijaya Hīrasūriji and Rev Śrīvijaya Dānasūriji that while one is performing the ritual of Pratikramana or Yōga (a special type of ritual process) in the rainy season or in the rest of the seasons, if the light of lightning falls, there is a failure-of-conduct and Kālagrahana (a special type of ritual process) fails

(2) Question If the light of lamps etc touches the body of man in moon-light, does it cause a failure-of-conduct?

Answer It is traditionally believed that if the moon-light touches the body of man, the light of lamps etc does not cause a failure-of-conduct, but if the moon-light does not touch the body of man, the light of lamps etc causes a failure-of-conduct The book Sandēha-dōlāvalī-prakarana written by Ācārya of Kharatara sect also says same thing

In the beginning of the 14th century of the Vikrama era, Śrī Jinadattasūriji, the disciple of Śrī Jinavallabhasūriji wrote the book 'Sandēha-dōlāvalī-prakarana' This book is in the question-answer form The reference to this point is found in the commentary on verse 41 and 42 and it seems that traditional belief that light contains life started from that time though no such meaning is derived from the original verses of this 'Sandēha-dōlāvalī-prakarana' But the bruhadvrtti written by Vācanācārya Śrī Prabōdhacandra Gani gives a detailed discussion of this A summary of the discussion is as under

If a man (monk or nun or layman or laywoman) while performing Sāmāyika, Pratikramana touches electricity, a lamp etc twice thrice four times or many times, *he should make confession* (Ālōcanā) *of it Here the word 'etc'* means other living beings such as earth-bodies etc It means that living beings

should not be touched while one is performing Sāmāyika, Pratikramana etc Fire, lamps etc also contain life They should, therefore, not be touched The word 'lightning' is used in verses of 'Sandēhadōlāvalī' and there it means the lightning that appears in the sky and it has life But one who is performing Sāmāyika, Pratikramana cannot touch it Therefore commentators and others have taken the word 'lightning' to mean the light of lightning It can, therefore, be inferred that the tradition of believing that light of any kind of fire contains life, perhaps started from that time

On the other hand discussing the question 'whether light of lamps cause failure-of-conduct in moon-light,' the author of the Vrtti i e commentator of 'Sandēhadōlāvalī', says that light of the Sun and the Moon does cause a failure-of-conduct, but it is unremediable Soon afterwards he gives another answer or solution that the light of the Sun and the Moon only touches but since it is lifeless, there is no possibility of failure-of-conduct

But later on, he raised the doubt that light contains life by giving a citation from the Bhagavatīsūtra, a Jain canonical scripture Giving an answer to it, he quotes the words of the commentator Śrī Abhayadēvasūrijī that livingness of light of the Sun, the Moon etc is only a formality Really, it does not contain life The paudgalic (material) aggregates of residences i e vimānas or planes of the sun and the moon etc are earth-bodied, therefore, they contain life but their light does not contain life Since their body is far away, some living beings in the moon emit light that is not hot but cold because their Udyōtanāmakarma is operative Since their body is far away, some living beings in the sun emit light that is not cold but hot because their Ātapanāmakarma is operative The touch of their light therefore, does not cause failure-of-conduct

But here the doubt is raised that if it is so the light of electricity or lamps etc also does not cause failure-of-conduct because their fire-body is far away

Giving an answer to this the author of Vrtti of 'Sandēhadōlāvalī', says that Udyōtanāmakarma does not operate in fire-bodies and since they are not earth-bodies, Ātapanāmakarma does not operate in them because Āgamas, i e Jain canonical scriptures say that only the gross earth-bodies which are Aparyāptā (having inadequate bodily capacities) have the operation of Ātapanāmakarma How is it then that the light of lamps etc gives light and heat to distant objects?

Giving an answer to this, Vācanācārya Śrī Prabōdhacandra Gani says that as a result of operation of a hot touch and of Lōhitavarnanāmakarma, lighted fire-bodies spread over the surrounding region fire-bodies have no Prabhā (irregular spread, reflection etc of light) but these fire bodies being extremely subtle, they themselves are known as irregular spread, reflection etc of light

This last answer given by Vācanācārya Śrī Prabōdhacandra Gani is incomplete and contrast to the reference of Jīvābhigamasūtra, a Jain canonical scripture, stated in Śrī Haribhadrasūrijī's commentary of the Daśavaikālikasūtra, a Jain canonical scripture Śrī Haribhadrasūrijī Mahārāja clearly says that fire-bodies are grosser even than water-bodies Wind-bodies are subtler even than water-bodies Light particles are very much subtler than wind-bodies How can they be regarded as fire-bodies? This is an important question to ponder on

Another classification of pudgala (matter) is into Varganās (groupings) There are chiefly eight varieties of Varganās 1 Audārika 2 Vaikriya, 3 Āhāraka , 4 taijas, 5 Bhāsā , 6 Śvāsōcchvāsa , 7 Manō and 8 Kārmana The body of all living beings except the celestial (Dēva s) and hellish ones, is made of pudgala aggregates i e paramānu-units of the Audārika Varganā The body of celestial beings (i e devas) is made of pudgala aggregates (paramānu-units) of the Vaikriya Varganā

Monks, well-versed in the fourteen Pūrvas scriptures and endowed with Āhāraka labdhi, make use of pudgala aggregates (paramānu-units) of the Āhāraka Varganā in making the Āhāraka body Every living being of the world has the subtle bodies - taijas and Kārmana Bhāsā Varganā produces sound Śvāsōcchvāsa Varganā is used in taking breath Manō Varganā is used in making the mind (sensorium) and thinking

According to the Daśavaikālikasūtra, gross-subtle, gross and gross-gross material aggregates are assimilated in Audārika Varganā If we think that light contains life, it should be included in the gross-gross type of material aggregates But science has proved that light particles are very subtle and therefore, it seems proper to include them in the taijas Varganā If along with other Varganās, we regard the taijas Varganā as a subtle type of grouping, everything is all right It should be noted here that infinite paramānus (atoms) aggregates of all the eight Varganās are gradually subtler transformations and

they are made of infinite particles (atoms) It, therefore, seems logical and true to believe that light is lifeless

The Sēnapraśna mentions that light of electricity or a lamp, touching the body of a man, causes a failure-of-conduct (Aticāra) but it is not quite fruitless or frustrate The sense of this sentence needs to be understood

Firstly, Ācārya Śrī Sēnasūrijī Mahārāja clearly states that he heard it from Ācārya Śrī Hīrasūrijī It means that perhaps there was no reference to this in Āgamic literature or any literature of tapagaccha which was available at that time

Secondly, instead of answering the question whether light of lamps etc dies by touching the body of man in moonlight from Āgamic literature and literature of the tradition of tapagaccha, he quotes from 'Sandēhadōlāvalī' of Kharataragaccha written 200-250 years ago This means that tapagaccha had no such tradition but it came into tapagaccha from Kharataragaccha

Thirdly, if light of electricity or a lamp touches the body of one who is performing Sāmāyika, Pratikramana etc it causes a failure of conduct and the reason for this is that if light comes from somewhere into darkness at the place of performance of Sāmāyika, Pratikramana etc concentration is broken and mind is disturbed Also, everything looks clear in light and the performance of Sāmāyika Pratikramana etc becomes easy and comfortable The performer therefore, likes light and silently supports the act of lighting up the lamp But it is not fit for a monk or nun to support it because he is forbidden to do it or cause or support it to be done It can, therefore be inferred that Ācārya Śrī Hīrasūrijī perhaps said that under these circumstances the performance of rites i e Sāmāyika Pratikramana etc of monks and nuns causes a failure-of-conduct because it supports the act of lighting up the lamp

According to the modern physics also light is only in the form of electromagnetic waves The atmosphere is now-a-days teeming with thousand million kinds of electromagnetic waves Their speed i e velocity is also as great as the velocity of light i e 3 00 000 km/sec Its frequency is very high or very low and therefore, we cannot see it

Thus thousand million kinds of electromagnetic waves dash against every living being on the earth now-a-days If we think that they all are living beings, it would be difficult to live on earth Every living being emits, from his body

waves of a certain kind of frequency according to his physical capacity and spiritual development and the wave-length, frequency of these waves change according to his mental conditions i e peace, danger, anger, agony, sorrow etc It is on this basis that the branch of science called telepathy has developed In western countries, many research works are done and are being done on this subject

It is stated regarding Āgāra (आगार) of Kāusagga (काउसग्ग) mentioned by the word अगणीओ (Aganīō) in the following verse of the prakrit commentary of Āvaśyakasūtra, a Jain canonical scripture

अगणीओ छिंदिज्ज बोहिअ खोभाइ दीहडक्को वा । आगारेहिं अभग्गो उसग्गो एवमाइहिं ।।
aganīō chindijja bōhia khōbhāi dihadakkō vā
āgārēhim abhaggō usaggō ēvamāihim

यदा ज्योतिः स्पृशति तदा प्रावरणाय कल्पग्रहणं कुर्वतोऽपि न कायोत्सर्गभङ्गः ।

'*yadā jyōtih sprsati tadā prāvaranāya kalpagrahanam kurvatō'pi na kāyōtsargabhangah* ' (If a flame of fire is touched during Kāyōtsarga, the Kāyōtsarga is not broken by taking a piece of cloth for wrapping)

But two meanings of the word (Aganīō) mentioned in this verse are given in the Gujarati commentary entitled 'Prabōdhatīkā' on Pratikramanasūtra This verse belongs to the niryukti of Annatthasūtra, the Āvaśyakasūtra

1 If fire comes spreading and if the performer of Kāyōtsarga (Kāusagga), goes to another place to complete Kāusagga, the Kāusagga is not broken

2 The second meaning is that which is shown in the commentary on Āvaśyakasūtra

Nowhere among words related to fire-bodies in his dictionary, 'Abhidhāna-cintāmani ' Kalikāla Sarvajña Śrī Hēmacandrācāryajī has shown 'light' to be a fire-body In 'Abhidhānarājēndra' too, there is no mention about this

Of the two meanings noted above, the first meaning seems to follow the Āgamas, the original Jain canonical scriptures The second meaning is not clear Of course, the original verse of the niryukti does not show 'light' to be a fire-body, nor does the second meaning clearly show that 'light' in the form of a fire-body, has life Even then, those who believe that light has life depend on that reference and its meaning But looking to the nature of the other three

considerations shown herewith the second meaning does not seem to be proper

Only omniscients know the reality (तत्त्वं तु केवलीगम्यम् - *tattvam tu kēvaligamyam*).

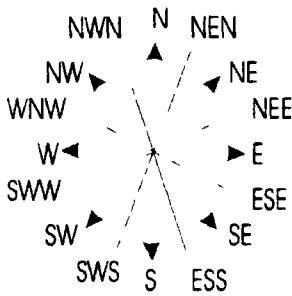
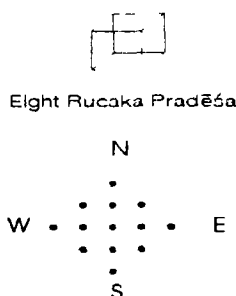
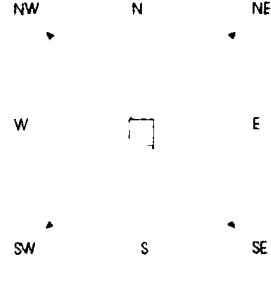
The sum and substance of all this discussion is that it is a characteristic of fire-bodied lives to emit electromagnetic waves in the form of light It is, therefore, not proper to believe that there is life in any kind of light

This does not mean that I agree that the monks and nuns should be allowed to read, write, or do other activities at night in the light of a lamp nor I have written this article in order to get such freedom Really speaking, monks and nuns cannot use lamps for themselves nor can they make others use lamps, nor should they regard him to be good who lights up a lamp or extinguishes it or switches an electric lamp on or off This means that they should not encourage him Also, they are not allowed to do any work in the light of other house nearby or in the light of the municipal lamp because they thus encourage the use of light Everyone accepts that though the lamp is not lighted for the monk or on his asking, it is sinful to use it There is no question therefore of giving or asking for such freedom This is only a humble attempt to find an answer to the question whether light contains life

(Reference Books The commentary on the Dasavaikālikasūtra by Śrī Śrī Haribhadrasūriji The commentary on the Tattvārtha Sūtra by Srī Siddhasēna Gani The commentary on the Ācārāngasūtra by Śrī Silāṅkācāryaji, The Sēnaprasna The Sandēha-dōlāvali prakarana The Abhidhāna cintāmani by Kalikāla Sarvajña Srī Hēmacandrācāryaji The Abhidhāna-Rājēndra by Rājēndrasūriji The Āvasyakasūtra niryukti, Text book of Quantum Mechanics by P M Methews & K Venkatesan)

(Special Research issue of Sankalpa magazine & Tīrthankara, Jan , 1988)

23. Directions In Jain Āgamas

All have heard the name of the device called compass and many have also seen it The dial on compass shows directions as in figure No 1 Generally, people believe that there are only ten or eight directions [1] They are counted as under east, west, north, south, north-east, south-east, south- west, north-west, the direction up wards and the direction downwards Of these ten directions only eight can be shown on the dial The upward and downward directions cannot be shown because a three-dimensional medium is necessary to show them, but a dial is always two-dimensional

The compass shows directions as stated above Moreover as shown in figure No 1, it shows the directions NEE between north- east and east, ESE between east and south-east, ESS between south-east and south, SWS between south and south-west, SWW between south-west and west, WNW betwen west and north-west, NWN between north and north-west and NEN between north and north-east

The English language has words only for the four principal directions – east, west, north, south There are no words for subdirections (विदिशा) They are, therefore, named by the joint name of the two adjacent principal directions e g For the corner between the north and the east, the word north-east is used Similarly, for the corners between the east and the south, the south and the west, the west and the north, the words east-south, south-west and west-north are respectively used But in Indian literature, different

words are used for different sub-directions This shows that the Indian literature has a vast vocabulary There being no special words for bisections of sub-directions in English, it is thought that they are shown only for convenience But Ācārānga, the holy Jain canonical scripture mentions these bi-sections of sub-directions Also, the nature and kinds of directions are fully discussed

Generally, the outer space is thought to have no directions The direction from which the Sun rises on the earth is considered to be the east direction, but in outer space there is no sunrise or sunset

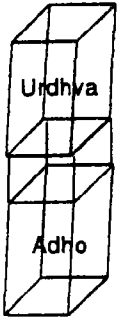
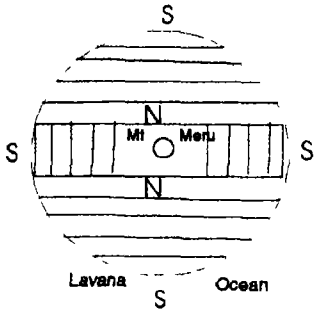
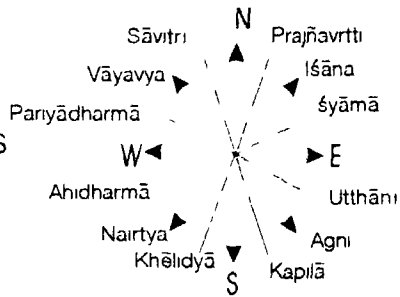
The Jain canonical scriptures also consider that direction to be the east from where the Sun rises But they do not accept that the outer space is quite directionless

Since eight rucaka pradēśas (i e space points or space units) which are of the shape of a cow's teats and which are at the centre of the universe and they are the orgin of all directions and sub-directions the outer space too has directions [2]

Generally, the Jain canonical scripture entitled the Ācārānga, describes a figure for showing directions and it has thirteen space points or space units It is represented as shown in figure No 2 [3] Jain scriptures also show how directions and sub-directions are formed The four principle directions are as wide at an origin as two space points As the directions go one space point further from the centre, their width increases by two space points and the four sub-directions go one space point further in a straight line in their respective corners [4] They are shown in figure No 3 The directions upwards and downwards are in a series of four space points

Describing the shape of all the four directions and sub-directions, Śrī Bhadrabāhusvāmī the author of Niryukti on Ācārāngasūtra, says that all these four principal directions are of the shape of the yoke of a cart because these four principal directions are narrow at their origin and as they go further, they become wider The four sub-directions are like an unbroken string of pearls The directions upwards and downwards are like upward and donward line of four rucaka pradēśas (space points) each [5]

The directions in respect of the eight rucaka pradēśas (space points) at the centre of the universe as shown above, are the real directions Also

there are directions from the view point of the teller, (Parjñāpaka) who tells the directions They are called Parjñāpaka - directions There are also directions in respect of the region (ksētra) like Bharataksētra Airavataksētra etc They are called ksētra-directions

According to Jain scriptures, Mt Mērū in Jambūdvīpa is at the centre of the whole of the Tiryak-Lōka (madhya-Lōka) and the Sun, the moon, the planets, the constellations and the stars always go on moving around it in a circle The direction of sunrise is called the east and the other directions are represented with reference to it [6] Since the Sun comes from the east-Mahāvidēhaksētra at the time of sunrise in the Bharataksētra it is the east direction for Bharataksētra and Mt Mērū is in the north The south direction of Bharataksētra, is the east direction for the west-Mahāvidēhaksētra and Mt Mērū is in the north to west-Mahāvidēhaksētra too The ksētra-directions of Airavataksētra is quite opposite to the directions of Bharataksētra The east of Airavataksētra is really the west of Bharataksētra and the west of Airavataksētra is the east of Bharataksētra The north of Bharataksētra is the east of east-Mahāvidēhaksētra and the south of Bharataksētra is the west of the east-Mahāvidēhaksētra Mt Mērū is always to the north and the Lavanasamudra (Lavana ocean) is always to the south as shown[7] in Figure No 5

The ksētra-directions of Bharataksētra are similar to the real directions of the whole universe

Parjñāpaka - directions पज्ञापकदिशा

In representation of ksētra-directions and real directions only ten directions are shown But in representation of Parjñāpaka - directions, the author of Niryukti on the Ācārāngasūtra, shows eighteen directions

Parjñāpaka is one who shows directions The direction infront of the person, sitting or standing or in respect of whom, directions are to be repre sented, is called the east even if it is the south or the west or the north [8] As the direction before the Parjñāpaka is the east, the direction behind the Parjñāpaka is the west The direction to his left is the north and the direction to his right is the south The directions between these four principal directions are called sub-directions These make eight directions There are eight more sub-directions intermediate between these eight directions [9] All these sixteen directions have the height and thikness of Parjñāpaka The directions upwards and downwards are of the size of the Parjñāpaka's body and of the shape of a thik staff i e stick [10]

Jain scriptures give the names of the four sub-directions in both the ways The method adopted for naming the directions as the north-east, east-south south-west and norht-west in the English language is also an ancient method Śrī Bhadrabāhusvāmī, the author of Niryukti on Ācārāngasūtra shows the names of the directions thus 1 east, 2 east-south 3 south, 4 south-west 5 west, 6 north-west 7 north 8 north-east,[11] though in presentation of real directions he describes south-east as Agni, south-west as Nairrtya north-west as Vāyavya and north-east as Īśāna

The intermediate sub- directions between any two adjacent directions of the eight directions, are named by the author of Niryukti on Ācārāngasūtra as 'Śyāmā, Utthānī, Kapilā, Khēlidyā Adhidharmā Pariyādharmā, Sāvitrī and Prajñavrtti '[12] Srī Śīlānkācārya, the commentator does not clearly say whether the names of these eight intermediate sub-directions should be started from the sub-direction between east and north-east or from the sub-direction between east and south-east But since the names of sub-directions are started from the north-east sub-direction, it will be proper to start from direction between the east and the north-east

Seeing these references of directions in Jain canonical scriptures, the common man may ask why it is necessary to describe these directions in Jain

philosphy which is soul-oriented Man's soul and every soul has been transmigrating since beginningless time In order to know where he was, in what surroundings, he was in the last birth, it is necessary to know the form situation of the universe As a part of it, the form of directions is described here Here is a reference given by the scripturist as under -

" Here in this world, some people do not know whether they (their souls) have come here from the east, from the west, from the north, or from the south or from sub-directons (विदिशा) or from the upward direction or from the downward direction "[13]

Śrī Bhadrabāhusvāmī, the author of Niryukti on Ācārāngasūtra represent the science of directions as a special explanation of this sūtra There is a special method of composing commentaries on Jain canonical scriptures i e Āgamas The name, representation and especially the obvious and intrinsic aspects of every word or component of a compound word are explained in detail Similarly, the directions mentioned above are general directions that are famous in all societies and men They are called in Jain techanical term Dravyadiśā (द्रव्यदिशा) i e obvious aspect While for the scripturist and monks and nuns who are learning, only intrinsic directions Bhāvadiśā (भावदिशा) are important They are also eighteen in number A detailed explanation these Bhāvadiśā is found in the Niryukti of Śrī Bhadrabāhusvāmī and commentary of Śrī Śīlānkācārya on Ācārāngasūtra Being irrelevent, it is not given here

References

1, इदग्गेई जम्मा य नेरूती वारूणी य वायव्वा ।
सोमा ईसाणावि य विमला य तमा य बोद्धव्वा ।। (आचाराग निर्युक्ति गाथा-४३)

टीका - आसामैन्द्री विजयद्वारानुसारेण शेषा प्रदक्षिणत सप्तावसेया ऊदर्ध्व विमला तमा चाधो बोद्धव्या ।

imdaggēī jammā ya, nērūtī vārūnī ya vāyavyā
sōmā īsānāvi ya vimalā ya tamā ya bōddhavvā (ācārānga niryukti gāthā 43)

tīkā - āsāmaindri vijayadvārānusārēna śēsāh pradaksinatah saptāvasēyāh ūrddhvam vimalā tamā cādhō bōddhavyā

2 अट्ठ पएसो रुयगो तिरिय लोयस्स मज्झयारम्मि ।
एस पभवो दिसाण एसेव भवे अणुदिसाण ।। (आ नि गा - ४२)

attha paēsō ruyagō, tiriyam lōyassa majjhayārammi
ēsa pabhavō disānam, ēsēva bhavē anudisānam (ā ni gā - 42)

3 तेरस पएसिय खलु तावइएसु भवे पएसेसु ।
ज दव्व ओगाढ जहन्नय त दस दिसाग ।। (आ नि गा ४१)

तत्स्थापना- त्रिबाहुक नवप्रदेशिकमभिलिख्य चतसृषु दिक्ष्वेकैकगृहवृद्धिकार्या ।।

tērasa paēsiyam khalu, tāvaiēsum bhavē paēsēsum
jam davvam ōgādham, jahannayam tam dasa disāngam (ā,ni gā 41)

tatsthāpanā- tribāhukam navapradēśikamabhilikhya catasrsu diksvēkaikagrhavrddhikāryā

4 दुपएसाइ दुरूत्तर एग पएसा अणुत्तरा चेव ।
चउरो चउरो य दिसा चउराइ अणत्तरा दुन्नि ।। (आ नि गा ४४)

dupaēsāi durūttara, ēga paēsā anuttarā cēva
caurō caurō ya disā caurāi anattarā dunni (ā ni gā 44)

5 सगडुद्धी सठिआओ महादिसाओ हवति चत्तारि ।
मुत्तावली य चउरो दो चेव हुति रुयगनिभा ।। (आ नि गा ४६)

sagaduddhi santhiāō, mahādisāō havanti cattāri
muttāvali ya caurō, dō cēva hunti ruyaganibhā (ā ni gā 46)

6 जस्स जओ आइच्चो उदेइ सा पुव्वदिसा होइ ।
जतो अ अत्थमेइ उ अवरदिसा सा उ णायव्वा ।।४७।।
दाहिण पासम्मि य दाहिण दिसा उत्तरा उ वामेण ।
एया चत्तारि दिसा तावखित्ते उ अक्खाया ।।४८।। (आ नि गा ४७ ४८)

jassa jaō āiccō, udēi sā puvvadisā hōi
jatō a atthamēi u avaradisā sā u nāyavvā 47
dāhina pāsammi ya dāhina disā uttarā u vāmēnam
ēyā cattāri disā, tāvakhittē u akkhāyā 48 (ā ni gā 47, 48)

7 जे मदरस्स पुव्वेण, मणुस्सा दाहिणेण अवरेण ।
जे आवि उत्तरेण सव्वेसि उत्तरओ मेरू ।।४९।।
सव्वेसि उत्तरेण मेरू लवणो य होइ दाहिणाओ ।
पुव्वेण तु उदेइ, अवरेण अत्थमइ सूरो ।।५०।। (आ नि गा ४९-५०)

jē mandarassa puvvēna, manussā dāhınēna avarēna
jē āvı uttarēnam savvēsım uttaraō mērū 49
savvēsım uttarēnam mērū, lavanō ya hōı dāhınāō
puvvēnam tu udēı, avarēnam atthamaı sūrō 50 (ā nı gā 49-50)

8 जत्थ जो पण्णवओ कस्स वि साहइ दिसासु य णिमित्त ।
जत्तो मुहो य ठाई सा पुव्वा पच्छओ अवरा ।।५१।। (आ नि गा ५१)

jattha jō pannavaō, kassa vı sāhaı dısāsu ya nımıttam
jattō muhō ya thāı, sā puvvā pacchaō avarā 51 (ā nı gā 51)

9 दाहिणपासम्मि उ दाहिण दिसा उत्तरा उ वामेण ।
एयासिमन्तरेण अण्णा चत्तारि विदिसाओ ।।५२।।
एयासि चेव अटठण्हमन्तरा अटठ हुति अण्णाओ । ।।५३।। (आ नि गा ५२-५३)

dāhınapāsammı u dāhına dısā uttarā u vāmēnam
ēyāsımantarēnam annā cattārı vıdısāō 52
ēyāsım cēva atthanhamantarā attha huntı annāō 53 (ā nı gā 52 53)

10 सोलस सरीर उस्सय बाहल्ला सव्व तिरिय दिसा ।।५३।। (आ नि गा ५३)

sōlasa sarıra ussaya bāhallā savva tırıya dısā 53 (ā nı gā 53)

11 पुव्वा य पुव्वदक्खिण दक्खिण तह दक्खिणावरा चेव ।
अवरा य अवरउत्तर उत्तर पुव्वुत्तरा चेव ।।५६।। (आ नि गा ५६)

puvvā ya puvvadakkhına dakkhına taha dakkhınāvarā cēva
avarā ya avarauttara uttara puvvuttarā cēva 56 (ā nı gā 56)

12 सामुत्थाणी कविला खेलिज्जा खलु तहेव अहिधम्मा ।
परियाधम्मा य तहा सावित्ती पण्णवित्ती य ।।५७।। (आ नि गा ५७)

sāmutthānī kavılā khēlıjjā khalu tahēva ahıdhammā
parıyādhammā ya tahā sāvıttı pannavıttı ya 57 (ā nı gā 57)

13 सुय मे आउस ! तेण भगवया एवमक्खाय - इहमेगेसि णो सण्णा भवइ । त जहा - पुरत्थिमाओ वा दिसाओ आगओ अहमसि दाहिणाओ दिसाओ वा आगओ अहमसि पच्चत्थिमाओ वा दिसाओ आगओ अहमसि उत्तराओ वा दिसाओ आगओ अहमसि उडढाओ वा दिसाओ आगओ अहमसि अहो वा दिसाओ आगओ अहमसि अण्णयरीओ वा दिसाओ आगओ अणुदिसाओ वा आगओ अहमसि एवमेगेसि णो णाय भवति ।। सूत्र - १-२।। (आचारागसूत्र प्रथम श्रुतस्कघ प्रथमाध्ययन सूत्र - १ -२)

suyam mē āusam ! tēnam bhagavayā ēvamakkhāyam ıhamēgēsım nō sannā bhavaı tam jahā puratthımāō vā dısāō āgaō ahamamsı, dāhınāō dısāō vā

āgaō ahamamsi, paccatthimāō vā disāō āgaō ahamamsi, uttarāō vā disāō āgaō ahamamsi, uddhāō vā disāō āgaō ahamamsi, ahō vā disāō āgaō ahamamsi, annayarīō vā disāō āgaō anudisāō vā āgaō ahamamsi, ēvamēgēsim nō nāyam bhavati Sūtra - 1-2

(Ācārāngasūtra Prathama Śrutaskandha Prathamādhyayana, Sūtra 1 2)

But Aristotle himself believed that questions concerning the human soul and the contemplation of God's perfection were much more valuable than investigations of the material world

When all in the world understand beauty to be beautiful then ugliness exists when all understand goodness to be good then evil exists

The notion that all opposites are polar—that light and dark, winning and losing, good and evil are merely different aspects of the same phenomenon—is one of the basic principles of the Eastern way of life

Fritjof Capra

24. Celibacy: A Scientific Analysis

Today AIDS has spread all over the world For married men, the only preventive which can ward it off is the vow of sexual satisfaction confined to *one's own life partener and for others, it is observance of celibacy* (Brahmacarya) Today man is everywhere surrounded by deterioration which is mistaken for culture Therefore, lessons on the importance of celibacy are as futile as music falling on deaf ears But there is a class of society today which thinks about celibacy from physiological and hygienic view points and it is a good indication The society today is so much dazzled by scientific achievements that it relies on scientific results as ultimate truth But scientists of all branches admit that though they have revealed many secrets of nature, many more secrets are yet to be revealed Therefore, no research in the field of science should be accepted as the ultimate or absolute truth [1]

Generally it is in the nature of human beings and for that matter of all animals to accept soon what is suitable to them The instincts of food, fear, sex and possession are so strong in all living beings from beginningless time that they soon accept the thoughts that are suitable to these instincts That is why the so-called researches of sexologists and the researches of psychologists like Freud are accepted sooner than researches showing the importance of celibacy Freud says "Desires should not be suppressed Suppressions of desires create many perversions If natural desires are suppressed, the suppressed desires make man perverted and mad Desires should, therefore, not be suppressed "

Of course, these researches are not totally invalid or baseless But they are only one side of the coin The later half of their conclusions and statements is as under Regarding celibacy, Freud himself says Semen has a great strength That strength should be well channelised By observing celibacy mental/intellectual and physical strength should be increased We should, therefore, also think of other side of the coin In case of women they can preserve the sex hormones by obeserving the celibacy through which they attain youth forever First, we shall talk of the scientific and medical experi-

ments showing the benefits of observing celibacy and then we shall think of scientific aspects of celibacy shown by great sages of ancient times

In this connection 'Science of Regeneration', the book written by Raymond Bernard is worth reading He says that man's sexual tendencies are fully controlled by endocrine glands The endocrine glands produce sex hormones and they control other glands Youth subsists on abundance of sex hormones in the blood As endocrine glands decrese the production of sex hormones, we begin to experience old age and weakness Semen is a treasure of inexhaustible strength By protecting and preserving it man can maintain his energies and youth for a very long time

Freud himself observed celibacy from the age of 40 The secret of life of a long-lived and physically and mentally strong man is, in most cases the observance of celibacy Great men of the world, Einstein, Leonardo da Vinci, Michelangelo, Isaac Newton, Morarji Desai etc observed celibacy since youth though they were householders Plato also said that sportsmen and athletes should observe celibacy for a certain period before participating in sports

If celibacy is not observed by body, speech or mind /sensorium sex hormones flow out of the body of men and women The sex hormones are mostly made of lecithin, phosphorus, nitrogen, and iodine, the components which are very useful to life, body and brain The latest research works show that the chemical, lecithin nourishes the brain The test of blood of mad men in lunatic asylums shows that lecithin is almost absent Studies of their past lives show that in thier youth, most of them had fallen in a bad company Indulgence in excessive sexual plays is dangerous to a house-holder's life Sometime one has to give up hope for life as a result of excessive sexual plays

Modern science does not lag behind in making experiments for regaining youth, rejuvenation etc All those experiments can produce energy in body only for three or four years These experiments have proved it beyond doubt that in order to sustain, youth endocrine glands should be kept active and sex hormonmes in blood should be abundant The sex hormones should not be made to flow out of the body as a result of failing to keep or preserve celibacy either physically vocally or mentally [2]

In these days of excessive indulgence in sexual enjoyments, is it

possible to observe perfect celibacy physically, vocally or mentally ? Most of the people will answer this question in the negative But in my opinion the observance of celibacy is very simple and natural if the nine rules of celibacy, which in Jain terminology, are called nine *guptis* (*restrictions related to activities of body, speech and mind*) of celibacy are rightly and strictly observed The nine rules of celibacy are as under [3]

1 One should live in a place devoid of woman (man), a beast or a eunuch

2 A lonely man/woman should not tell religious stories or give sermon to a lonely woman/man A man should refrain from talks about a woman and a woman should refrain from talks about a man

3 A woman should not sit by a man on a comon seat As long as 48 minutes, a man should not sit on a seat left by a woman and as long as three hours a woman should not sit on a seat left by a man

4 A woman should not look steadily at eyes face and other organs of man's body nor should a man look steadily at eyes, face and other organs of a woman's body

5 One should leave the place, where words of amorous plays of a woman and a man from the other side of the wall are heard

6 One should abstain from recollections of amorous plays indulged in previously

7 One should abstain from very oily, nutritive and infatuating food

8 One should not take in excess even the dry unoiled or arid food

9 One should not attractively and artistically cut or decorate hairs on the head, hairs on the body finger-nails or toe-nails One should refrain from cosmetic treatment and bodily decoration

Celibacy has a great importance in the Svāmınārāyana religion also Śrī Nışkulānandajī of that religion has made a poem on the nine rules of celibacy This shows the importance of celibacy

The nine rules of celibacy are perfectly scientific and their scientific analysis can be given as under

The first rule of celibacy says that a monk or nun should stay in a place,

which is uninhibited by the opposite sex or a eunuch or a beast etc This rule is very important and full of scientific secrets

Every living being has electricity of a very subtle power In the sea, there is a fish named electric eel [4] It produces a powerful electric current Where there is elctric power,there is magnetic power Thus we all have bio-electro-magnetic power [5] Therefore, every living being has his bio-electro-magnetic field Scientists have proved this It is a general rule of magnetism that like poles repel and unlike poles attract, if they are within the magnetic field of each other

Men and women have their bio-elctro-magnetic poles in the opposite order Eunuchs can also have their magnetic poles, but in my opinion they are not definite because magnetic poles depend on changes in mind i e thoughts When an eunuch's mind changes, its magnetic poles also change The sexual excitement of eunuchs is great, and therfore, their magnetic power and magnetic field are very strong Changes of poles go on in eunuchs like an alternate current of electricity If, therefore, a monk lives in a place inhabited by a woman, a beast or an eunuch, on account of attraction of unlike poles, it becomes very difficult for him to observe celibacy In order to observe celibacy fully it is necessary for a monk to stay in a place uninhabited by a woman, an eunuch or a beast

The second rule of celibacy is that a lonely monk should not tell religious stories to lonely women and a man should avoid talking about a woman and a woman should avoid talking about a man

When a lonely man talks to a lonely woman, generally the woman looks at the man and the man looks at the woman Since the bio-elctro-magnetic poles of a man and a woman are in the opposite order, when they look at each other the elctro-magnetic lines emerging from their poles, join together and as their electro-magnetic fields join together, their bio-electro-magnetic attraction becomes stronger In these circumstances, if their electromagnetic waves are of unequal frequency , their mutual attraction also becomes unequal If the wavelength and the amplitude are not proportionate, the thoughts in their minds mutually differ from each other As a result the circuit of magnetic-electric current remains incomplete But if the electro-magnetic waves emerging from them have equal frequency, their power of attraction also becomes equal If the wavelength and amplitude of the

waves are equal, the circuit of the magnetic-electric current is also completed As a result, strong mental attraction is produced and that becomes ultimately the cause of fall of a self-restrained man

It should be noted here that according to the modern physics, the energy of bio-electro-magnetic waves, which in Jain terminology are called Varganā (paramānu-units of matter), depends upon their frequency This can be shown in physics by the equation $E = nhf$ Here E denotes energy, f denotes frequency, n denotes integers i e 1, 2, 3, 4 etc , and h is the Planck's constant i e The greater the frequency, the greater is the energy *The kind of bio-electro-magnetic waves depends on the wavelength and* amplitude of the waves i e The wavelength and ampiltude of common thoughts may be equal

Further in the fourth rule of celibacy, it is stated that a woman should not look steadily at the eyes, face and other organs of a man nor should a man look steadily at the eyes, face and other organs of a woman For that also, this is the reason

According to the third rule a woman and man should not sit on a common seat Moreover, for as long as 48 minutes a celibate man should not sit on a seat left by a woman and for as long as three hours a woman should not sit on a seat left by a man

While a man sits at a place, an atmosphere is formed around his body The atmosphere can be good or bad according to the thoughts of the person's mind Moreover, invisible particles also drop from the body of the person A mushroom, which is called Anantakāya according to Jain scriptures, sprouts up anywhere in the rainy season If its upper portion is cut off, and put up side down on a piece of paper for a while, the particles emitted from the mushroom, will make a circular figure there Similarly, particles drop from the body of a man or a woman and lie there for a long [6] These particles produce a bad effect on our mind and defile it That is why this rule is included in the nine rules of celibacy

The fifth rule of celibacy says that one should keep away from a place near a small house where the words of amorous plays of a man and woman on the other side of the wall, are heard and the sixth rule says that one should abstain from recollections of amorous plays indulged in former life as

a house holder

Both these types of activities defile the bio-electro-magnetic field of a person Really speaking pure or impure, good or bad thoughts of our mind make our bio-electro-magnetic field good or bad

When electricity is passed through steel, it also becomes magnet and, like a magnet, it has its own magnetic field But a peculiar characteristic of the bio-electro-magnetic field of living beings is that they can expand or contract it to any extent and in any direction as the amoeba can expand or contract its pseudopodia Really speaking, according to the belief of Jain philosophy, the magnetic field is formed by Manō Varganā (paramānu-units of material particles) emitted by sensorium, as the sensorium is made of material particles When a man looks at a particular object or person in a particular direction, his magnetic field extends as far as the object or person Of course, mathematically, the magnetic field of any living or non-living thing extends as long as infinite distance but it has very little influence on very distant objects

When a man thinks of sensual pleasures with a woman his mind attracts the woman's mind and thoughts of mind create attraction between unlike poles of each other Their mind gets united the circuit of bio-electromagnetic current is completed misconduct is unknowingly and invisibly committed and there is a mental breach of celibacy

Electricity is an energy and it is stored in a battery It has positive (+ve) and negative (-ve) poles The chemical substance is between the poles and this energy is stored in it Unless the positive pole and the negative pole are joined, the energy is not used But as soon as the poles are connected, the energy begins to be used and ultimately it is exhausted Similarly, inexhaustible and undivided energy is accumulated in the world in the form of men and women Men and women are two poles of it When these two poles are connected in one way or another, energy comes to be used This connection is established in five ways (*1) through the actual sexual intercourse, (2) only through touch, (3) through eyes,(4) through words and (5) through mind or sensorium This is why scripturists have forbidden one who fully and sincerely observes celibacy to touch a person of opposite sex, to look steadily at him or her, to talk with him or her for a long time or even to think of the person of opposite sex

The description of sexual pleasures of celestial beings given in the fourth chapter of the ancient Jain scripture, 'The Tattvārtha Sūtra' supports this statement Śrī Umāsvāti, the author of the 'Tattvārtha Sūtra' says that gods who live up to Saudharma, the first heaven and Iśāna, the second heaven satisfy their sex urge with actual sexual intercourse Of the higher types of gods, some enjoy sexual pleasures only through touch, some enjoy only through eyes, some enjoy them through words and some enjoy them only through sensorium [7]

If the other person is only imaginary, is energy used up? Generally, there is not a living person in front of him who reads a sexual novel or a sexual part of a novel In his mnd there are only imaginary characters imagined by the novelist Does one loose his energy by thinking of the imaginary characters? This can be replied in the affirmative on the basis of the modern science and ancient narrative literature

In ancient stories, we come across incidents which show that, sages of distinguished power created with their thinking power or will powerspecial charaters of a young girl etc for a particular purpose and when the purpose was fulfilled, they dissolved what they had created The same thing happens here at a subtler level The strong will-power of the reader of a novel creates an imaginary character invisibly with subtle pudgalas i e paramānus of the surrounding atmosphere and as soon as the mental association of the reader with the character, joins both the poles of the bio-electro-magnetic current the electro-magnetic circuit is completed and consequently the reader's energy is consumed That is why they who observe self- restraint should abstain from reading very sexual novels or literature

For observance of celibacy, very oily, nutritive and stimulative food should be abstained from For every living organism, food is an important source of energy, which is necessary for life Generally a monk should not take milk, curds, ghee, jaggery, oil and sweets for his food The Jain scripturists call all these six substances to be infatuating food items because they can produce infatuation in the body But if a monk is constantly engaged in study, thinking, meditation and specially learning and teaching and if he is physically weak, scripturists allow him to take all the six kinds of infatuating food items with his guru's permission Food should be eaten only to get necessary strength of the body Infatuation is also caused by getting more than neces-

sary physical strength For observance of celibacy, one should, therefore, not take very oily and nutritive food

Similarly, food without milk, curds, ghee, oil, jaggery, sweets etc , taken in excess, also leads to physical deterioration and inactiveness Therefore, even dry food must be taken in a limited quantity

Semen is an energy If the semen produced in our body is prevented from being wasted, it gets sublimated To put it in terms of modern science according to the natural arrangement in our body semen itself is again absorbed in blood, reaches the brain and ultimately fast develops in the form of intellect and memory Spiritually speaking, this is the sublimation of energy

Celibates are also forbidden to shave or cut attractively and artistically hairs on the body, hairs on the head, finger-nails, toe-nails and to take cosmetic treatment because celibates natuarlly have a bright personality, full of vitality Their celibacy is their bathing and chastity is fragrance They, therefore, do not need a bath and a cosmetic treatment If they take bath and cosmetic treatment, they may look bright and shiny and become a centre of attraction for others As a result, the magnetic field i e sensorium of some other person may become defiled by inauspicious thoughts A contact with a person of defiled magnetic field may soon defile the magnetic field of a celibate person A celibate therefore should not decorate his body nor should he take bath or cosmetic treatment

Even in these days, it is possible to observe physical and mental celibacy, if one strictly follows these nine rules

It is said that the credulous god Śankara opened his third eye and with flames of fire shooting out from it he reduced Kāmadēva to ashes Thinking scientifically about this, we know that our endocrine glands are controlled by the centres of our brain below the Brahmarandhra (crown cakra) called third eye (Ājñā Cakra) i e in the straight line in the place of third eye of Śankara With his spiritual practice, if the ascetic makes these centres inactive, desire for sexual enjoyments, can be thororughly eradicated In this sense, any ascetic can even today thoroughly eradicate, with his 'third eye', the desire of sexual enjoyments

It is also my experience that abundant strength for observing devoted celibacy is obtained by keeping company with saints who observe devoted

celibacy and by remembering the names of such great persons who lived in the near past

I take pride in writing that His Holiness Rev Gurudēva Śāsanasamrāt Ācārya Śrīvijaya Nēmisūriśvarajī Mahārāja, who lived in near past and was very benevolent to us all was highly illuminated with his devoted celibacy and the daily prayer that we offer to him gives us the strength to observe celibacy He was born in Mahuva (Saurashtra, India) and in Mahuva, he died also As luck would have it this article comes to an end in proximity of his majestic foot-prints engraved in marble, in the Upāśraya erected at the place of his death

In conclusion, I hope that this article will remove false notion of people regarding celibacy and all will properly observe celibacy according to their capacity and will make their lives sublime

References

1 Truth is generally beleived to be absolute however in the domain of science, the results of scientific investiagations do not always fit into this expecta tion Grinnal says that the reality described by science is not complete or absolute since changes occur with alternations in scientific attitude (Everyman's Science, 1993, p 131, Published by ISCA Calcutta)

2 On account of restrictions of a monk's life I donot enter into a detailed analysis of this but I suggest that the readers may read, for other scientific aspects Shri Kanti bhatt's article 'Advantages of Celibacy' (second part) in 'Jñāna Gathariyā' column in the Shatadal supplement of 'Gujarat samachar' of wednsday February,17, 1993

3 'Sramanakriyā Nā Sūtrō' (artha sahita) p 260

4 In an acquarium a fish named 'Electric Eel' is presesved This fish produces an electric current of 600 volts and with that electricity, the board 'Electric Eel' is lighted

5 In a foreign country a woman had an amazing electric energy If an electric bulb was put into her hand, it got lighted up This is what I read long ago

6 Now a photographic technique has been invented If someone sits at a place for some time and then goes away and if a photograph of his former place is taken, his figure and aura stand out in the photograph In future, this tech-

nique will be used to identify criminals

7 कायप्रवीचारा आ ऐशानात ।।८।। शेषा स्पर्श-रूप-शब्द-मन प्रवीचारा द्वयोर्द्वयो ।।९।।
kāyapravicārā ā aiśānāt 8 śēsāh sparsa-rūpa-śabda-manahpravicārā dvayōrdvayōh 9 (The Tattvārtha Sūtra, chapter 4, Sūtra 8-9)

This will be fully understood by reading a detailed explanation and commentary of these Sūtras

> FOR AN UNDERSTANDING OF ANY OF THE PHILOSOPHIES TO BE DESCRIBED , IT IS IMPORTANT TO REALIZE THAT THEY ARE RELIGIOUS IN ESSENCE THEIR MAIN AIM IS THE DIRECT MYSTICAL EXPERIENCE OF REALITY, AND SINCE THIS EXPERIENCE IS RELIGIOUS BY NATURE, THEY ARE INSEPARABLE FROM RELIGION MORE THAN FOR ANY OTHER TRADITION THIS IS TRUE FOR HINDUISM
>
> FRITJOF CAPRA

25. Advantages And Secrets Of Penance : The Scientific View-point

The Jainism prescribes various means to follow dharma for spiritual evolution of soul Whatever chief means you adopt, other means also become useful in a subsidiary way

A very important means of self-realization is penance Penance is chiefly of two kinds External penance and internal penance Century after century non-Jain philosophers pondered over the external penance prescribed in Jain scriptures and every time they presented it as mortification of body or supression of self or supression of senses Even in the scientific age of today, we are overawed by splendour and prosperity of external penance but they who call it as useless and hypocritical are not few Really speaking, though external penance restrains sensual pleasures and desires, purification of soul or thought or mind is not attained because external penance is not combined with internal penance The external penance alone can, therefore, not lead one to salvation The kinds and rules of external penance, shown in the Jain scriptures are full of secrets of science Though they cannot lead one to salvation in the present era, they are very beneficial from the physical and hygienic view-ponts

First of all, let us think of abstention from taking food at night

Various magazines etc often write about scientific advantages of abstention from taking food at night It is, therefore, not necessary to deal with it in detail here Generally, physical activities and exertion are not engaged in at night and therefore, the function of metabolism is very slow and therefore, he who eats food at night probably suffers from indigestion and diseases of gas At night in the absence of sun-light minute insects are born in the atmosphere and do a lot of harm Only the sun-light, having mysterious power or energy, can destroy atmospheric pollution and useless insects and prevent the production of new insects Jain scriptures forbid to take food at night, including forty-eight minutes before sunset and forty-eight minutes

after sunrise At sunrise and sunset, small insects namely a flies, mosquitoes etc do a lot of harm Since insects start causing trouble at sunset and stop causing trouble at sunrise, they are especially numerous at those times

Generally, taking food only twice a day, is not regarded as a penance But from practical view-point, taking food only twice a day (Biyāśana) is regarded as a penance Since food is taken at a sitting only twice a day, there is a complete abstention from taking food and water at night and only boiled water is used during day-time, from the hygienic view-point there is no possibility of diseases being spread through insects in water By taking food only twice a day one abstains from irregular food habits and unwholesome and improper food

Ēkāśana means taking meal at a sitting and only one time a day Nothing else except boiled water is taken throughout the day The new generation habituated to take tobacco and flavourings (masala) every now and then, finds it difficult but it is not at all difficult for Jains, living life of regular habits If food is taken regularly only once a day, the body gets complete rest at night Therefore blood and oxygen are needed in a very small quantity for the functioning of various parts of the body and the heart and lungs are not over strained The whole body gets complete rest A wonderful alertness is experienced in doing morning duties After a good mental, intellectual and physical exertion taken during the day, rest is needed In a one time meal or a two time meal a day, one takes food of one's own choice but abstains from food described in Jain scriptures as Anantakāya i e modifications of various roots e g potato, sugar-bit, green ginger, onion etc unwholesome and unfit-to-be eaten One does not, therefore, fall a victim to deteriorations pro-duceufd by all kinds of unfit-to-be eaten, unwholesome and an anger-pro-voking (Tāmasika) food

Food is chiefly of three kinds Sāttvika (conducive to the highest of the three qualities of nature), Rājasika (conducive to the second of the three qualities of nature) and Tāmasika (conducive to the lowest of the three qualities of nature) During penance of a one time meal a day or a two time meal a day, generally, limited Sāttvika food should be taken Sometimes, Rājasika food also taken for the sake of taste But one should fully abstain from Tāmasika food because it is anger-provoking, nutritive and stimulating He who lives according to norms of morality described in Jain scriptures, can

easily and naturally abstain from Tāmasika food His health is not, therefore, at all deteriorated unless he is careless and fails to follow even the general rules for maintaining health

Āyambila is a special type of penance, in which tasteless and dry food is taken only once a day In this penance, six infatuating food items (Vigais) namely milk, curds, ghee, jaggery (sugar), oil and sweets are abstained from Turmeric and chillies are also not used Spiritually speaking, by this type of penance, the sense of taste come under control and therefore, all the other senses are conquered, the four spiritual defilements (Kaṣāyas) and mind are conquered As a result, the bondage of karma is reduced and when there is a lot of cleansing off karma, one approches salvation

This type of penance has many other advantages, too Since ghee, milk, curds, jaggery and sweets which produce mucus and green vegetables which generally stimulate bile are fully abstained from in this type of penance, mucus and bile are tranquilized by practising this type of penace

From the Ayurvedic view-point, the root of all diseases lie in the imbalance of gas, bile and mucus elements created in the body In everyday life, food causing mucus and bile is taken excessively The proportion of mucus and bile, therefore rises in the body and health is endangered If it is possible the penance of Āyambila should be practised four or five times a month Scripturists have greatly obliged us by prescribing performance of the nine day penance (continuous Āyambilas) in the month of Caitra and Āśvina And this is the secret of it The month of Caitra and Āśvina fall in the transition period of two seasons and in the transition period, changes occur in health If discremination is not used regarding wholesome and unwholesome in this season, one sometimes becomes a victim to a long-term illness It is said in Ayurveda vaidyānām śāradī mātā, pitā tu kusumākarah (वैद्याना शारदी माता, पिता तु कुसुमाकर ।) (For physicians, Śarada - one of the six seasons of the year covering Āśvina and Kārtika months- is as good as mother and Vasant i e spring- one of the six seasons of the year covering the Caitra and Vaiśākha months - is as good as father) It is in these two seasons that people fall ill and the doctors and physicians earn a lot If possible, the penance of nine days - Āyambila , from 7th day of the first half of Caitra and Āśvina , to 15th day of first of Caitra and Āśvina , should be performed

Fast is a distinct type of penance of Jainism This penance is chiefly of two types 1 Tivihāra Upavāsa means taking only boiled water during the day time 2 Cauvihāra Upavāsa means nothing can be taken as food and water also are abstained from According to the Jain tradition a fast begins in the evening of the previous day and it is completed in the morning of the next day It means that a fast is of thirty-six hours in all In the fast of the Jain tradition, tea, milk, cofee, fruits, sweets made of condensed milk or dry fruits as in fasts of other traditions are not taken nor is it a symbolic fasts of 12 hours from 8 a m to 8 p m observed in order to realise some political object Such a symbolic fast is begun after a full breakfast in the morning and after the end of the fast in the evening a full dinner is taken But in Tivihāra Upavāsa of the Jain tradition, only boiled water is taken from 10 a m to 6 p m A Cauvihāra Upavāsa is complete abstainment for full 36 hours from the evening of the previous day to the morning of the next day and not a single drop of water is taken i e water is also fully abstained from

There are only three necessities of life, food, water and air It is necessary to take needed wholesome food regularly in order to keep the body fit If less food is taken or no food is taken, the body becomes weaker and weaker and in the long run it becomes unable to do other activities For digestion of food, water is very indispensable The body contains 75 to 80 % water If water is reduced in body on account of passing tools or vomitting, blood-pressure fast begins to decrease and the body becomes uneasy One has therefore to take glucose-water etc , to prevent dehydration Water is also therefore, very indispensable for subsistence of life Oxygen is very indispensable for process of metabolism By combustion of fat and sugar through oxygen, we get necessary energy Oxygen is taken from air through breathing Air contains nearly 20 % oxygen Not even for a few minutes can a human being nor any living being nor even a plant live without air Without water one can live for some hours and without food one can live for some days Form the scientific view-point, a fast of many days can, therefore, be observed by taking only water and no food Without taking any food or water, a fast can be observed only for four or five days and not for a longer period

Besides being a means of self-purification and self-control, a fast is a means of purification of the body and of control of internal activities of body By observing a fast one disposes of the internal solid waste of the body Bile,

mucus and gas produced in the body are controlled or thrown out and the body is purified Some people vomit bile on the second or third day of fasting Really speaking, the surplus bile in the body is vomitted out and the body feels relief During a fast only boiled water is taken and therefore, the surplus faeces is excerted Since they get no food, worms ec themselves go out And if there is mucus accumulation, it is removed Since surplus bile and surplus mucus go out of the body, gas, bile and mucus are balanced Therefore, at least a one day fast should be observed in a fortnight or in amonth That is why scripturists have mentioned a one-day fast as a fotnighty atonement Generally, the body of virtuous and self-restrained monks and nuns who constantly observe a fast of three days or more is occupied by gods and goddesses He who performs penance is helped by gods and goddesses If an ordinary man observed a long fast of eight days, eleven days, fifteen days, thirty days or forty-five days, he generally becomes physically weak or lean and incompetent but by virtue of his will power and spiritual power he can do without food for many days Some people can abstain from both food and water as long as 16 days Those who have even an ordinary knowledge of science will find this very surprising But thinking further on this point, we find that our body takes three days in adjusting with a new situation During the first three days it opposes the new situation During these first three days its physical and mental functions are disturbed but when the reaction of the body does not get any external response, the body gets adjusted to the new situation According to this principle, during routine days our body gets heat and energy from the food and water that we take But it does not consume fat and glucose lying within the body, it is so accustomed When we observe a fast or an Āyambila, our body tries to get heat and energy from the food and water taken from outside but since it is totally stoped to take food and water, the body resists the new situation in the form of hunger etc And if our will-power is not strong, we break the fast If we do not break the fast and continue to observe fast, our body instead of getting heat and energy from outside, gets necessary heat and energy from fat, glucose etc stored in the body This arrangement is setteled in three days They who go to America from India and come to India from America take three days to get the biological clock of their body adjusted to the new surroundings In medical terminology it is called 'jet lag' During the three days, they sleep during day time and keep awake at night, they do not become hungry during day

time but at night as before The mind also remains up set and disturbed for sometime That is why the ambassadors who go to foreign country are instructed not to take decisions on policy matter or make confidetial deliberations for three days This is the reason why one does not feel hungry or weak after the first three days of his fast During the three days, the body makes alternative arrangements for getting heat and energy

In short, the penance of Navakāraśī (taking food and water after 48 minutes of sunrise), Cauvihāra (not taking food and water etc during the whole night) Biyāśana (taking food only twice a day), Ēkāśana (taking food only once a day), Āyambila (taking only once aday, food without ghee, oil, milk, curds, jaggery, sweets etc), a fast of 36 hours (Upavāsa), etc prescribed in the Jain tradition, is fully scientific from the view points of medical science and physiology Besides spiritual benefits, it brings numerous advantages of physical health They should not be overlooked Even if one is allergic to the words 'religion' and 'religious', the penance described above and its rules should be observed in the name of science and health

IT MOVES IT MOVES NOT
IT IS FAR IT IS NEAR
IT IS WITHIN ALL THIS
AND IT IS OUTSIDE OF ALL THIS

ISHA UPANISHAD 5

26. Prohibition Of Fresh Vegetables On Parva-Tithis - Auspicious Days : A Scientific View-Point

From very ancient times Jains are famous all over the world for their food habits and life-style All their religious doctrines and rules of food habits and life-style are perfectly scientific because they were not introduced by an ordinary person After having obtained omniscience, Śramana Bhagavān Mahāvīra expounded them for the greatest welfare of not only his disciples, monks and nuns and laymen and laywomen but also for the greatest welfare of the entire human race and the whole living world If they are scrupulously and wisely observed, they, no doubt, secure self-welfare By observing these rules, many living beings secured self-welfare and ultimately attained the final liberation Ancient scriptures give such illustrations

Among many rules of food habits prevalent in the Jain tradition, there is a rule in the Śvētāmbara Idolatrous sect that forbids the use of fresh vegetables (greens) on the twelve parva-tithis (the second, fifth, eighth, eleventh, fourteenth and fifteenth days of the bright half and dark half of every month) or five parva-tithis (the fifth, eighth and fourteenth days of the bright half and the eight and fourteenth days ofthe dark half) of every month, the seventh to fifteenth days of the bright half of the months of Caitra, Āśvina , Kārtika, Phāgana and Āsādha and eight days of Paryusanā parva This tradition is not new It is many centuries old and it has authenticity of Āgamas In the book of life of ten śrāvakas, entitled 'Ānanda-sundara' [1] composed in the first half of the sixteenth century of Vikram era, there is a reference to Parva-tithis as under

पर्वाणि सन्ति सर्वज्ञैर्भाषितानि जिनागमे ।।२६४।।
सांवत्सरं चतुर्मासत्रय चाष्टाह्निकाद्वयम । मासग पर्वषटक वा, पक्षगा पञ्चपर्व्यपि ।।२६५।
एतेषु निरतीचार पञ्चाचारपरो नर । शुभं परभवायुष्क बध्नाति शुभकर्म च ।।२६६।।

यदुक्त महानिशीथे भयव ! बीया पमुहासु पव्वतिहीसु विहिय धम्माणुट्ठाण किं फल हवइ ? गोयमा ! बहु फल हवइ । जम्हा एयासु पव्वतिहीसु पाएणं जीवो परभवाउयं कम्मं समजणइ, तम्हा सावएणं

पृ. ८

A reference of Ānanda Sundara written in 1549 Vikram Era, depicting the life of ten Śrāvakas mentions about Parva tithis and prohibition regarding eating of life containing fruits fresh/green vegetables on Parva-tithis

पृ. ११

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सावियाए साहुणा साहुणीए वा अन्नेण वा जीवेणं तवो विहाणाइं धम्माणुट्ठाणं सुहपरिणामेणं कायव्वं ।

parvāni santi sarvajñairbhāsitāni jināgamē 264
sāmvatsaram caturmāsatrayam cāstāhnikādvayam
māsagam parvasatkam vā, paksagā pañcaparvyapi 265
ētēsu niratīcāra-pañcācāraparō narah
śubham parabhavāyuskam, badhnāti śubhakarma ca 266

yaduktam mahāniśīthē - bhayavam ! bīyā pamuhāsu pavvatihīsu vihiyam dhammānutthānam kim phalam havai ? gōyamā ! bahu phalam havai jamhā ēyāsu pavvatihīsu pāēnam jīvō parabhavāuyam kammam samajanai, tamhā sāvaēnam sāviyāē sāhunā sāhunīē vā annēna vā jīvēnam tavō vihānāim dhammānutthānam suhaparināmēnam kāyavvam

"In Āgama scriptures, Omniscient Tīrthankaras have enumerated parvas thus six eight-day-festivals which are as under 1 The Paryusanā festival, 2, 3, 4 three eight-day-festivals of the month of Kārtika, Phāgana and Āsādha, 5-6 two eternal (Śāśvatī) eight-day-festivals (though they contain nine days) of months Caitra and Āśvina These are all called Atthaī i e eight-day-festivals There are six parva-tithis in a month or five parva-tithis in a fortnight ten parva-tithis in a month On these auspicious days, a human being perhaps acquires the life-span for next birth and other auspicious karma for the next birth

It is said in the Mahāniśīthasūtra, "O Lord ! What is the result of observing religious rules on parva-tithis such as the second day etc of each fortnight etc ?

Gautama ! The result attained is great A living being probably binds āyusya (life-span) of the next birth on these days of parva-tithis Laymen, laywomen, monks and nuns should therefore, perform penance etc with auspicious thoughts"

In the same scripture, there is a further verse as under

द्वितीयाद्या पञ्च पक्षे, मासे षट् तिथयोऽथवा । सावद्यारम्भसच्चित्तत्यागं तास्वेव भावये ।।

dvitīyādyāh pañca paksē, māsē sat tithayō thavā
sāvadyārambhasaccittatyāgam tāsvēva bhāvayēh

"On the five parva-tithis (the second-day etc) in a fortnight or ten parva-

tithis in a month, one should abstain from sinful activities and from eating what possesses life "

What is the reason, why six parva-tithis are mentioned of a month and five parva-tithis are mentioned of a fortnight here, is not explained But in the Śrāddhadinakrtya Sūtra written by Ācārya Śrī Dēvēndrasūriji Mahārāja and in the vrtti writeen by him, there is a contex of six parva-tithis of a month as under

मूलम् छण्ह तिहीण मज्झम्मि का तिही अज्ज वासरे ? किं वा कल्लाणगं अज्ज लोगनाहाण संतियं ॥२१॥

स्वोपज्ञवृत्ति मासाभ्यन्तर इति गम्यते । षण्णां तिथीना सितेतराष्टमी-चतुर्दशी-पूर्णिमाऽमावास्या लक्षणानां मध्ये का तिथिरद्यवासरे ?

(श्राद्धदिनकृत्यसूत्रम् स्वोपज्ञवृत्तिविभूषितम - - ग्रन्थकारा श्रीदेवेन्द्रसूरय)

mūlam chanham tihīna majjhammi kā tihi ajja vāsarē ? kim vā kallānagam ajja lōganāhāna santiyam 21

svōpajñavrtti māsābhyantara iti gamyatē sannām tithīnām sitētarāstamī caturdasī-pūrnimā'māvāsyā laksanānām madhyē kā tithiradyavāsarē ?

(Śrāddhadinakrtyasūtram by śrī Dēvēndrasūriji)

"Of the six parva tithis the eighth days of the bright half and the dark half, the forteenth days of the bright half and the dark half and fifteenth days of the bright half and dark half, which parva-tithi is today ?"

Here, the fifth days of the bright half and the dark half of the month are not considered in the six parva-tithis of the month There is no clarification regarding the five parva-tithis of each fortnight Still however, the second, the fifth, the eighth , the eleventh and the forteenth day are perhaps included in the five parva-tithis of a each fortnight The full moon and the new moon day following the forteenth day of each half of the month succesively without interruption and for that reason they perhaps not regaded as parva-tithis

Since fresh vegetables (greens) possess life, one should abstain from the use of greens even as one's own food in order to avoid the himsā (violence) of greens and other moving organisms living under their shelter

It needs to be made clear here that it is not absolutely compulsory that all

laymen and laywomen should abstain from green vegetables on all parva-tithis That is why parva-tithis are differently enumerated Some laymen and laywomen observe five parva-tithis in a month, some observe six, some observe ten or twelve parva-tithis

The point is, on parva-days, one should do as little sin and as much auspicious deeds as possible

All kinds of green vegetables possess life Flour, rice, split pulses, etc do not possess life Wheat, barley, pulses like moong, matha, adada (black beans), grams, chola, tuver, (pigeon pea) etc may or may not possess life because they themselves become lifeless after some time of their complete growth The following statements are made about them in the chapter captioned 'Dhānyānām Abījatva Dvāra' in the book Pravacanasārōddhāra

जव १ जवजव २ गोधूम ३ सालि ४ वीहि ५ धन्नाण कोट्ठयाइसु ।
खिविऊण पिहियाणं किन्ताणं मुद्दियाणं च ।।९९५।।
उक्कोसेणं ठिइ होइ, तिन्नि वरिसाणि तयणु एएसिं ।
विद्धंसिज्जइ जोणी, तत्तो जायइ अबीयत्तं ।।९९६।।
तिल १ मुग्ग २ मसूर ३ कलाय ४ मास ५ चवलय ६ कुलत्थ ७ तुवरीणं ८ ।
तह कसिणचणय ९ वल्लाण १० कोट्ठयाइसु खिविऊण ।।९९७।।
ओलित्ताणं पिहियाणं लंछियाणं च मुद्दियाणं च ।
उक्किट्ठ ठिइ वरिसाण पंचगं तत्तो अबीयत्तं ।।९९८।।
अयसि १ लट्टा २ कंगु ३ कोद्दूसग ४ सण ५ वरट्ट ६ सिद्धत्था ७ ।
कोद्दव ८ रालग ९ मूलग बीयाण कोट्ठयाइसु ।।९९९।।
निक्खित्ताणं एयाणुक्कोसठिइए सत्त वरिसाइं ।
होइ जहन्नेणं पुणो अंतमुहुत्तं समग्गाणं ।।१०००।।

java 1 javajava 2 gōdhūma 3 sāli 4 vīhi 5 dhannāna kōtthayāisum
khiviūna pihiyānam kittānam muddiyānam ca 995
ukkōsēnam thii hōi tinni varisāni tayanu ēēsim
viddhamsijjai jōnī, tattō jāyai abīyattam 996
tila 1mugga 2masūra 3 kalāya 4 māsa 5 cavalaya 6 kulattha 7 tuvarīnam 8
taha kasinacanaya 9 vallāna 10 kōtthayāisu khiviūnam 997
ōlittānam pihiyānam lañchiyānam ca muddiyānam ca
ukkittha thii varisāna pañcagam tatō abīyattam 998
ayasi 1 latthā 2 kangu 3 kōdūsaga 4 sana 5 varattha 6 siddhatthā 7
kōddava 8 rālaga 9 mūlaga bīyāna kōtthayāisum 999
nikkhittānam ēyānukkōsathiiē satta varisāim
hōi jahannēnam punō amtamuhuttam samaggānam 1000

"If barley, a special other kind of barley, wheat, paddy, a variety of rice, i e juwar, millet etc are stored in a vertical cylindrical container of grains etc made of mud and if it is properly covered, daubed with cow-dung etc they live as seeds possessing life as long as three years and then the organ of generation gets destroyed and seeds become lifeless They do not grow even if they are sown i e They become lifeless

Thus even if they are stored with great care as shown above, sesame seeds, different kind of pulses like moong, lentil, field peas, black beans, chola, kalathi, pigeon peas, grams, vaals etc certainly become lifeless after five years

If linseeds cotton seeds, kangoo (cereals like yellow rice), kodara (a kind of cheap coarse corn), jute, white rapseeds, kodari (husked grains of kodara), ralaka (a kind of kangoo), radish etc are stored in a vertical cylindrical container and preserved as above, saved from insects as described above, they can possess life as long as seven years as living seeds and then they certainly become lifeless "

The life span shown above is the longest The shortest life-span for all kinds of grains is an Antarmuhūrtta i e a period of less than 48 minutes It means that after life is created in a grain/seed, if its life span is completed within 48 minutes it becomes lifeless But omniscient beings know it Nescient beings do not know it Therefore, even if a seed has become lifeless it should not be used This is the reason why Śramana Bhagavān Mahāvīra did not grant permission to his thirsty group of monks to drink from pond water which had naturally become lifeless on account of destruction of water body's lives caused by the heat of the Sun

As shown above grains can be lifeless Therefore, abstinence from greens-vegetables does not cause that much sin that is caused by the use of greens As a result there is less bondage of karma

There is one more logical and scriptural reason why man should abstain from greens on parva-tithis If he abstains, he does not develop attachment towards greens, fruits etc

Generally, green vegetables, fruits etc have much more taste, sweetness etc than dry pulses Man, therefore prefers green vegetables, and fruits to dry pulses If he eats various fresh vegetables, fruits etc he will

form a habit and will not be able to do without green vegetables, fruits etc even for a day and he will develop attachment towards them He will cultivate a habit for green vegetables and fruits We can know it from the following illustration

Pēthadaśā, a minister and king's advisor was a Jain merchant In the beginning of his career, he dealt in ghee It was Pēthadaśā's policy to sell only fresh ghee every day Fresh ghee has distinct smell and taste They who bought ghee from Pēthadaśā's shop never bought it from anyone else King Jayasimha always got fresh ghee from Pēthadaśā's shop and took his meal

Once the king's maid-servant went to Pēthadaśā's shop to buy ghee Pēthadaśā has been out Pēthadaśā's son Jhāñjhanaśā was there in the shop The maid-servant asked Jhāñjhanaśā to give her ghee Jhāñjhanaśā said, "No" He said that there was no ghee The king again sent the maid-servant to buy ghee but she did not get ghee The king did not take his meal He sent for Jhāñjhanaśā and asked him reason Jhāñjhanaśā said, "Oh, King ! There was plenty of ghee but before the maid-servant came to buy ghee another customer had come He sneezed and the vessel containing the ghee was open at that time Since it was open the poisonous matter excreted from the body of the house lizard might have dropped into it Thinking of this possibility, I did not give ghee to your maid-servant "

In short, attachment for tasty food may develop into a habit To avoid attachment, we should eat greens only intermittently

It is a general principle to karma philosophy that one is born among those for whom one develops attachment In scriptures there are many illustrations about this Not even gods are in exception to this If they develop attachment for beautiful gems of heaven which are earth bodies, sweet smelling water of stepped wells, wells, ponds etc , beautiful fregrant flowers etc gods of heaven also after their death, are born as earth bodies among gems etc , as water bodies, as trees, flowers etc among plants

Gods in heaven do not use fire and wind etc In absence of any pleasure derived from them, gods do not develop any attachment for them Therefore after their death in heaven, gods are never born as fire bodies or wind bodies

Lest man should continuously relish the taste of green and fresh vegetables and fruits, lest he should develop attachment for such worthless things as green vegetables and fruits and lest he should take birth among them, parva-tithis are perhaps arranged inorder to abstain from green vegetables and fruits at an interval of every two days

By the way, it needs to be noted here that there is a possibility of production of minute organisms in unsplit pulses and therefore monks and nuns do not take unsplit pulses (gram etc) as food during the rainy season and on parva- tithis

Really speaking, it is not very necessary for those who are vegetarians to take greens But those who are non-vegetarians need to take greens in their diet because the non-vegetarian diet does not contain carbohydrates, salts, vitamins etc that are necessary for a human body Besides flesh etc have no fibres and the want of fibrous food may cause constipation They should, therefore, take greens in a large quantity Experiences of physicians also prove this Vegetarians regularly take fresh vegetables and therefore, they do not suffer from such diseases They, therefore, do not need to take more green vegetables

Greens are full of haemoglobin It gets oxygen from air and purifies blood in lungs Since it is not at all there in non-vegetable diet i e flesh etc , the body of non-vegetarians becomes pale Since there is a good amount of haemoglobin in the body of vegetarians, they do not need to take greens Besides, there is a lot of haemoglobin in pulses etc

Speaking from the Ayurvedic view-point, green vegetables increase bile and pulse increase gas If green vegetables are taken excessively, bile is excited In order to prevent it and in order to maintain the balance of gas, bile and mucus, one should abstain from fresh vegetables at intervals of two days It is also necessary that he should eat pulses Parva-tithis also come approximately after an interval of two days The first parva-tithi is the second day of the lunar month then after two days comes the fifth day then eighth, eleventh and fourteenth days after an interval of two days each At the end of the whole fortnight, the fourteenth and fifteenth days come as joint parva-tithis The only reason for this is that if the bile has slightly increased during the fortnight, it can subside as a result of abstinence from green vegetables continuously for two days

The nine days from the seventh to the fifteenth days of the bright fortnight of the months Kārtika, Phāgana and Āṣādha are called days of aththais (a religious eight or nine days festival coming at the interval of four months) Really speaking, this is a period of transition In this season, imbalance of gas, bile, and mucus occurs in the body Health is reduced Restrictions of food become necessary Similarly, the periods of observance of nine-day-long penance in the month of Caitra and Āśvina are favourable to diseases It is said somewhere '*vaidyānām śāradī mātā, pitā tu kusumākarah* (वैद्याना शारदी माता, पिता तु कुसुमाकर ।)' (For physicians, the season Śarada is mother and the season spring is father)

During these periods, mucus is much excited Therefore, wise people have prescribed that penance of Āyambila should be performed in these days It reduces mucus and bile He who performs this penance abstains not only from green vegetables, fruits etc but also from ghee, oil, jaggery (sugar), milk, curds, sweets, chillies and sour food because they cause mucus
It should be noted that along with green vegetables, unripe or ripe fruits too are considered green But very few Jains abstain from ripe fruits The Jain religion is ultimately a religion of renouncement The greater the renouncement, the greater the benefit Therefore, when laymen and laywomen take the vow of abstinence from green vegetables etc , they abstain from them to the extent they decide

Thus it is proper that on parva-tithis, we who are vegetarians, should abstain from green vegetables from religious, scientific, hygienic and Ayurvedic points of view

References

1 This book is not yet published A manuscript of this book written in the year 1549 of Vikram era, is in collection of L D Institute of Indology, Navarangpura, Ahemdabad 380009 Another manuscript is in the collection of Ācārya Śrīvijaya Nēmisūri Jñānaśālā, Khambhāta This book is written on the basis of the Jain canonical scripture entitled ' Upāśakadaśāṅga '

27. 'Vigais' And 'Mahāvigais'

[I have recently got the book 'Role of Vegetarian Diet in Health and Disease' published by the Bombay Hospital, Institute of Medical Science Preceding the index, there is a section 'Our Contributors', which contains photos of all the writers, doctors etc who have contributed articles to the book The most important fact of the book is that not a single writer or doctors a Jain All are eminent scholars of their subject On the basis of scientific research, they have supported vegetarianism In writing this article on Vigais and Mahāvigais, I have made use of this book — The author]

"The philosophical aspect of the Jain religion is logical and therefore, it is irrefutable It is not questionable But as far as geography, astronomy, fitness and unfitness of food to be eaten etc are concerned, various questions were raised in different ages and if some doubts are raised on account of them, there is nothing surprising " [1]

During the last four or five decades, science has made a remarkable progress Today everyone is probably overpowered by achievements of science He, therefore, thinks of every rule and principle of religion, morality or good conduct from the scientific view point Not largely but to a very small extent *norms about food that is fit or unfit to be eaten, have been changing* from time to time It is, therefore, very necessary to scrutinize the changed modern norms about food that is fit or unfit to be eaten So much material is available on this subject that a book can be written on it But in view of the limited space available here, we shall think only about 'Vigais and Mahāvigais'

विगइ (Vigai) or विगय (Vigaya) is originally a prākrta word Its samskrta form is विकृति (vikrti) The thing which is capable of bringing about a change in nature, quality or form of soul or mind and of defiling it is called a vikrti in the Jain terminology [2] The things which have greater such capacity, are called Mahāvikrtis According to Jain scriptures vikrtis are six in number 1 milk 2 curds 3 ghee, 4 oil, 5 jaggery or sugar, 6 fried food [3] Mahāvigais

include 1 Butter, 2 Honey, 3 Wine, 4 flesh (or meat).[4] Jain laypersons who are purified by the true quality of a śrāvaka keep away from all these four Mahāvigais whose names begin with letter 'ma'(म) for life long time Others are Jains only by birth, not by deeds They have destroyed the limit, grandeur and splendour of the word 'śrāvaka' It is a matter of deep worry for us, these things have been adopted by Jains who have lost the Jain quality

As far as possible, a real śrāvaka keeps the five anuvratas, three gunavratas and four śikṣāvratas The discussion of the seventh vow bhōgōpabhōga viramana vrata contains some description of what is fit and what is unfit for a śrāvaka to eat 1 honey 2 butter 3 wine and 4 meat are strictly prohibited there We shall think of them later on Let us now think of Vigais which are generally eaten

Jain scriptures clearly do not allow monks and saints to take milk, curds, ghee, oil etc without a special reason or condition or by exception Only a fatigued monk or a physically weak monk or a monk excessively devoted to scriptural study or meditating can use Vigais according to the permission of the Ācāryas etc These Vigais are forbidden because they defile the mind and the body as their names suggest Therefore, it is not proper for a healthy man to take ghee, milk, curds etc in a great or excessive quantity

1 Milk

From a scientific point of view, milk is a perfect food Milk contains probably all kinds of elements necessary for human body Therefore, milk is considered to be very necessary for man There are some people who say that milk is obtained /derived from female animals and it should, therefore, be abstained from It is like non-vegetarian food But what they say is not true If this is believed, then there is perhaps no person in the world who did not take milk in childhood Really speaking, for all living beings particular to the animals, milk is the primary necessity of life In the mamillae of every female it is produced for the nutrition of her children The first food for every child is milk whether the child is of a lioness, a deer, a cow, a buffalo or even a woman Milk is made for food and since infinite/bigininglesss times every human child has been taking milk as food It is, therefore, unnecessary to entertain such doubts about milk Of course, in the present times, the milk of cows and buffaloes is extracted with machines and sometimes in order to

get more milk, the machine is kept fixed for a long time and therefore, blood of animals possibly comes along with milk It is, therefore, proper to abstain from such milk But such possibilities are very slight in India

According to Jain scriptures, milk of cows, buffaloes, female goat, female camels, and female sheep is generally regarded as Vigais Only these five kinds of milk are regarded as Vigais Milk of no other animal is regarded as Vigai [5]

Milk contains protein called casein (80%) and it is easily digestible with HCL and rennin that secrete in the stomach Milk contains a good deal of fat and it is also easily digestible Along with them, there is a carbohydrate named lactose Milk also contains mineral elements namely, sodium, calcium, phosphorus, sulphur, magnesium, iron etc Though iron is in a very meagre proportion, its quality is the best That is why it soon mixes with blood [6]

2 Curds

Curds are made of milk Jain scriptures state that there are four kinds of curds If the milk of a cow,a femal buffalo, a female goat or a female sheep is coagulated, it becomes curds Curds are not made of the milk of a female camel Therefore, though there are five kinds of milk, there are only four kinds of curds [7] Whether curds are fit or unfit to be eaten is a question that arises from time to time There are some who say that when milk is spoiled and its original taste smell and colour are lost or changed it becomes curds There are some others who say that curds are not made without bacteria, Through a microscope in a laboratory, a large number of living bacteria are seen Therefore in view of himsā and ahimsā (violence and non-violence), curds should be certainly abstained from

If one believes that curds are a spoiled food, the belief is entirely wrong There is a great difference between the process by which milk is spoiled and the process by which the milk is coagulated Under the effect of atmospheric temperature when milk gets spoiled without curd being added to it, its colour, smell, taste etc are never like those of curds Some antibacterial micro-organisms are produced in it When curd is added to milk, the bacteria in curds called lacto-bacillus, transform milk into curds

A gastric juice named lactose is secreted in our body It transforms the carbohydrates named lactose occurring in milk into lactic acid If lactose is not produced or slightly produced in the body, it is preferable to eat curds instead of milk [8] Milk is heavy to digest , while curds are light It is, therefore, a stupidity to say that curds is spoiled milk

Generally, it is popular belief that curds are not coagulated without bacteria and, therefore, curds should not be eaten From a study of microbiology, we come to know that some bacteria that are sometimes found in milk etc do not die by any means even if you boil the milk as long as half an hour, because as the atmospheric temperature rises, bacteria of this kind make protection cover all around them which is called spore, and lie sleeping inside the cover till the atmosphere becomes favourable

The bacteria that turns milk into curds are of a special kind In our body too, there are a large number of bacteria and micro-organisms Even if milk is taken instead of curds, when it goes to the stomach, mixes with hydrochloric acid and gets transformed into curds We should, therefore, believe that curds can be taken as food even if it contains bacteria because the atmosphere favourable to their life, is present in our body also and therefore, they do not die and that is why curds are not prohibited in Jain scriptures But after two nights the curds become unfit to be eaten because the bacteria that make curds grow profusely and there is a possibility of growth of micro-organisms of other kinds

Scientifically speaking, all food items are mixed to a small or great extent with viruses and bacteria No food is, therefore, fit for us to eat But all food tems do not become unfit to be eaten simply because they contain bacteria

It is necessary to show here that dicotyledons from which oil cannot be extracted i e pulses namely black beans, moonga, chola (kind of pulse), gram, methi (foenugreek seeds) etc are not fit to be eaten with unboiled milk, curds (products of cow-milk, buffalo-milk) But dicotyledons from which oil is extracted namely oil-seeds, ground nuts, charoli (kind of dry fruit i e chirongia sapida), almond etc are fit to be eaten with unboiled milk, curds and their products The verses about pulses are as under

जंमि उ पिलिज्जंते, नेहो नहु होइ, बिंति तं विदलं । विदले विहु उप्पन्ने नेहजुअं होइ नो विदलं ।।१।।
मुग्गमासाइ पभिइं, विदलं कच्चमि गोरसे पडइ । ता तस जीवुप्पत्ति, भणंति दहिए वि दुदीणुवरिं ।।२।।
विदलं जिमिउं पच्छा, पत्त मुहं च दो वि धोवेज्जा । अहवा अन्नय पत्ते, भुंजिज्जा गोरसं नियमा ।।३।।

jammi u pilijjantē nēhō nahu hōi, binti tam vidalam
vidalē vihu uppannē nēhajuam hōi nō vidalam 1
muggamāsāi pabhiim, vidalam kaccammi gōrasē padai
tā tasa jivuppatti, bhananti dahiē vi dudīnuvarim 2
vidalam jimium pacchā, pattam muham ca dō vi dhōvējjā
ahavā annaya pattē, bhuñjijjā gōrasam niyamā 3 [9]

Here the second verse clearly shows that on the third day, curds become unfit to be eaten The third verse shows the method of eating curds as food After eating pulses the vessel and the mouth should be washed and curds should be taken as food or curds should be eaten from another vessel

Elsewhere, the verses are found as under

मुग्गमासपभिइ आमगोरसे जो भलइ । उवइ तसरासि असखजीवा मुणेयव्वा ।।१।।
विदले भोयणे चेव, कठे जीवा अणतसो होइ । उयरंमि गए चेव जीवाण न होइ उप्पत्ति ।।२।।

muggamāsapabhii āmagōrasē jō bhalai
uvai tasarāsi asankhajivā munēyavvā 1
vidalē bhōyanē cēva kanthē jīvā anantasō hōi
uyarammi gaē cēva jivāna na hōi uppatti 2 [10]

According to modern botany, pulses include all dicotyledon vegetables i e beans or pulses e g moongo, black-bean, bean, pea grams, chola, moth lentil, fenugreek etc from which oil cannot be extracted and ground-nut, cashew-nut, charoli, sesame, mustard seeds, almond, rape seeds, turiya, lady's finger etc from which oil can be extracted But according to Jain scriptures and tradition, pulses include only dicotyledons from which oil cannot be extracted

Here one doubt also arises that whether dahīmvadā / ghōlavadā are fit to be eaten or unfit to be eaten ? There are some uncertainties about dahīmvadā (kind of fried cakes made of pulses, dipped in curds) For lay-folk, dahīmvadā are shown to be unfit to be eaten and it is mentioned in the aticāra sūtra of lay-folk But the paccakkhāna bhāsya shows thirty food items of six soul defiling foods i e Vigais There fried cakes made of pulses,

dipped in curds are shown to be fit for being eaten

In my opinion, according to the verses quoted above, if fried cakes are dipped in unheated curds, they are unfit to be eaten, but if they are dipped in heated curds, they are fit to be eaten What is meant here by unheated curds? Is it curds made of unheated milk or curds made of heated milk but the curds so made is then not heated? It is not possible to find a solution to this question or many such other questions without making experiments Therefore a laboratory is essential for it

It is a rule, regarding to whey, observed by monks and nuns of the Śvētāmbara idolatrous sect of Jains that if unboiled water is poured into whey during churning it and all butter is taken out, the whey becomes lifeless The whey is drunk soon and time limit for use of that whey is two days Though in the present times, no monk accepts whey on the next day, this is heard traditionally There must be some reference in scriptures in support of it, but it has not yet come to my knowledge

And according to the tradition of Jain Śvētāmbara idolatrous sect, if unboiled water is poured into whey after churning, it remains with life up to 48 minutes and after 48 minutes, it becomes lifeless and monks and nuns may take it as a food This tradition is also now prevailing somewhere

3 Ghee

Curds are made from milk, whey is made from curds, butter is made from whey *and ghee is made from butter* When whey *is churned, butter surfaces* and floats When it is separated from whey and heated, butter is transformed into ghee Thererfore, there are as many kinds of ghee as curds It means that curds, butter and ghee are obtained from the milk of cows , buffaloes, female goats, and female sheep

Here a question may arise, if the butter, taken out of curds or whey is unfit to be eaten, how can ghee, which is made by heating the butter be fit to be eaten? *Really speaking, butter remains fit to be eaten as long as 48* minutes after it is taken out of whey Afterwards, micro-organisms of its own colour are produced in it Therefore, ghee should be made soon after butter is separated from whey

In the present times some non-Jain ghee makers go on collecting butter

for ten or fifteen days after the butter is taken out of whey and then make ghee out of it Many years ago, it was seen in the kitchen of a Jain gentleman in a city of south India that one afternoon when a cook began to heat in a vessel three or four big lumps of butter covered in a black piece of cloth, the butter began to melt and micro-organisms like larva appeared in it Therefore, the ghee so made, is unfit to be eaten But now-a-days there are machines which directly extract ghee (fat) from milk Also, cream of milk is accumulated It is heated and ghee is made Ghee thus made is, therefore, fit to be eaten

Scientifically speaking , ghee, oil etc are in reality a kind of fat which is necessary in body-machine for heat and energy In the body, it burns and produces energy that activates all other parts of body If a man takes more than necessary ghee, milk, curds etc the surplus fat gathers under skin and when for some reason or another a man does not get food or when he observes fast etc as a penance, the fat gathered under the skin, burns and produces energy Every man, therefore, should take ghee milk etc only in a limited quantity

4 Oil

As out of many kinds of milk, curds etc , only four or five are regarded as Vigais so Jain scripturists regard four kinds of oils as Vigais 1 of sesame seeds, 2 oil of lin seeds, 3 oil of rape seeds, 4 oil kusumbha (kind of plant or grass i e carthamus tinctorius) The remaining other oils are not regarded as Vigais [12] But ground nut oil, coconut oil etc should be regarded as Vigais In the times when these books were written probably most of the people mostly used only these oils in food and perhaps they did not even think of using the remaining oils That is why the author has included only these oils in the list of Vigais

The oil of sesame seeds makes the body strong and stimulates digestion Rubbing the oil body with it, makes the skin and eyes better Those who take sesame oil in food, do not suffer from paralysis The oil of rape-seeds cures gas and mucus, balances their proportion and also removes intestinal worms Rubbing the body with it, removes the dryness of the skin and makes the skin strong, smooth and tender The groundnut oil controls mucus [13]

5 Jaggery and Sugar

According to Jain scriptures, there are two kinds of jaggery 1 lump and 2 hard Both kinds of unheated jaggery are among Vigais [14] Jaggery gives a lot of strength Body becomes very strong by eating jaggery with dry fruits and roasted grams Even today jaggery and grams are fed to horses as it was done in ancient India Sugar soon spreads energy in the body Both are good source of energy [15] Jaggery stimulates the desire for sexual pleasures [16] Abstinent monks and those who can keep the vow of celibacy should not, therefore, eat unheated jaggery

Hygienically speaking, jaggery makes the heart strong and prevents various heart diseases [17] Jaggery water (sugar water), makes the kidney and the system of urine excretion clean [18]

6 Fried food

Food, fried in oil and fried in ghee are Vigais Food, fried first, second or third time in the same base of heated molasses, ghee or oil are called sweets [19] Another word for this is Avagāhika Frying in fourth, fifth, sixth etc times in the same base of heated molasses, ghee or oil makes the food non-Vigais because it cannot defile the mind or body of one, who eats it Through six Vigais, thirty varieties of non-defiling (non-Vigaic) food items are prepared And according to the tradition of the Jain Śvētāmbara idoltrous sect, when a monk or nun practices Yōga in order to get permission to study Āgama sūtras or when a śrāvaka (lay-person) practices penance of upadhāna in order to get permission to study Navakāramantra etc sūtras, he takes that food while taking his single meal a day (Ēkāśana) [20]

Of the four Mahāvigais, meat and wine do not need useless repetition Much has been told/written about them elsewhere But only their kinds will be described here

1 Meat

Jain scriptures show three kinds of meat 1 that of aquatic animals such as fishes etc 2 that of animals on lands such as a hog, a cow, a buffalo etc 3 that of birds etc flying in the sky such as the swan, the crow, the sparrow etc [21] According to Jain belief as soon as living animals die, innumerable micro-organisms of their colour are produced in their meat, blood etc It is,

therefore, necessary to abstain from them in order to keep the vow of non-violence [22]

2. Wine

According to the Jain scriptures, there are two kinds of wine 1 that which is directly derived from fruits and flowers (kāsthamadya) and 2 that which is made by bringing about organic decomposition in flour (pistamadya) [23] Jain scripturists say that wine is a cause of slackness (pramāda) Delirium is created by taking wine [24] The following sanskrit verse shows sixteen bad effects of drinking wine

वैरूप्य, व्याधिपिण्ड, स्वजनपरिभव, कार्यकालातिपातो, ।
विद्वेषो, ज्ञाननाश, स्मृति मतिहरण विप्रयोगश्च सद्भि ॥
पारुष्य, नीचसेवा, कुलबलतुलना धर्मकामार्थहानि ।
कष्ट भो ! षोडशैते निरुपचयकरा मद्यपानस्य दोषा ॥

vaırūpyam, vyādhıpındah, svajanaparıbhavah kāryakālātıpātō,
vıdvēsō, jñānanāśah smrtı matıharanam vıprayōgasca sadbhıh
pārūsyam, nīcasēvā, kulabalatulanā, dharmakāmārthahānıh
kastam bhō ! sōdaśaıtē nırupacayakarāh madyapānasya dōsāh [25]

In order to make wine, its component substances are organically decomposed and melted This is only one sort of bacterial fermentation which causes harm to mind and body That is why Jain scriptures entirely forbid wine-drinking

3 Butter

Butter is talked about along with ghee No repetition is, therefore, made here

4 Honey

Jain scriptures show that there are three kinds of honey 1 that which is collected by honey-bees, 2 that which is collected by male and female black-bees and 3 that which is collected by butter flies or moth-insects [26] Honey is only a nectar of flowers but in collecting it, it becomes necessary to kill innumerable insects like bees etc Therefore, from the point of view of violence, its use is forbidden The saliva from the mouth of bees etc gets mixed with honey and therefore, innumerable micro-organisms of its own colour are

produced They are very capable of defile our minds and, therefore, scripturists have forbidden it

About honey, butter, wine and meat, lives of ten śrāvakas entitled 'Ananda sundara' composed in the Vikram era 1549 states

मज्जे महुम्मि मसम्मि नवनीयम्मि चउत्थए । उप्पिजंति अणता तव्वण्णा तत्थ जंतुणो ।।९०३।।
अमासु य पक्कासु य, विपच्चमाणासु मसपेसीसु । सयय नियमुववाओ, भणियो य निगोय जीवाण ।।९०४।।

majjē mahummi mamsammi navanīyammi cautthaē
uppijanti anantā tavvannā tattha jantunō 903
amāsu ya pakkāsu ya, vipaccamānāsu mamsapēsīsu
sayayam niyamuvavāō bhamiyō ya nigōya jīvānam 904 [27]

Infinite micro-organisms of the same colour are produced in wine, honey, meat and butter In the tissues of meat that is uncooked, cooked or being cooked, infinite very small micro-organisms are continuously produced

Here a brief description of Vigais and Mahāvigais is given from scientific view-point on the basis of Jain scriptures It is hoped that after reading and understanding this, śrāvakas will raise in the society the grand image of a real śrāvaka

References

1 जैनधर्म का दार्शनिक पक्ष युक्तियुक्त है । उसके आगे पीछे कोई प्रश्न चिह्न नही है किन्तु जहा तक भूगोल-खगोल का प्रश्न है विभिन्न युगो मे तरह तरह के दबाव उन पर आए है अत उन्हे लेकर कुछ शकाएँ सामने आती है तो उसमे आश्चर्यजनक कुछ भी नही है ।

-- Dr Nemichand Jain 'Tirthankara' May 1987 p 5

2 3,4 5 7,11 12 14 19 20,21 23 26

pravacanasārōddhāra--pratyākhyāna dvāra verses 217 to 235 and its sanskrit commentary

6 8 13,15,16,17,18

Role of vegetarian diet in Health and Diseases p 5-6-76-85-86

9 10 Tirthankara September 1989 p 29

22,24,25 मासभक्षणदूषणाष्टकम्, मद्यपानदूषणाष्टकम् (अष्टकप्रकरणम् कर्ता आचार्य श्री

हरिभद्रसूरिजी)

Māmsabhaksanadūsanāstakam and Madyapānadūsanāstakam (Astakaprakaranam by Ācārya Śrī Haribhadrasūriji)

27 आनंदसुंदर प्रथमाधिकार श्लोक Ānanda-Sundara, Prathamādhikāra, Śloka

- 903 904

THAT WHICH IS A FINEST ESSENCE—THIS WHOLE WORLD HAS THAT AS ITS SOUL THAT IS REALITY THAT IS ATMAN THAT ART THOU

CHHANDOGYA UPANISHAD, 6 9 4

FORCE AND MATTER, PARTICLES AND WAVES MOTION AND REST, EXISTENCE AND NON-EXISTENCE—THESE ARE SOME OF THE OPPOSITE AND CONTRADICTORY CONCEPTS, WHICH ARE TRANSCENDED, IN MODERN PHYSICS

FRITJOF CAPRA

28. Water : Sentient And Non-sentient : A Scientific View-point

According to Jain scriptures water is a living organism Every molecule of it is a living organism Also, since it is a place of production i e birth-cavity of other living organisms, there are numerous organisms and micro-organisms in it They are capable of producing a number of diseases in the body It is, therfore, good for the sake of health to drink water after boiling it

In the present times at some places ash, lime or sugar is mixed with water in order to make it lifeless Though, according to the Jain canonical scriptures, water becomes lifeless if ash, lime or sugar is mixed with it, scriptures and other sources give no instruction about the quantity of ash, lime or sugar that should be added into water and about the preiod of time after which that water becomes lifeless Really speaking, it is proper only for monks and nuns to accept such water which has thus been made lifeless because if a layperson hurts earth, water, fire, air or vegetables i e plants or other living organisms in order to procure these things for monks or nuns, those monks and nuns commit a sin If water is thus made lifeless only for monks and nuns, it is not acceptable to monks and nuns even if it is lifeless

In ancient times, monks and nuns, during their begging rounds, were accepting in their begging bowls, water, in which pulses or rice had been washed or water containing some residue of flour left over at the end of baking breads if the water did not contain any grains or did not give any taste of flour or any eatable substance, and if the water could quench thirst And for the laypersons, it is prescribed that while practising penance or otherwise, they should drink thrice boiled lifeless water This was an ancient Śvētāmbara tradition based on scriptures In the present times, this custom prevails among monks and nuns of the some sects, groups, gachchas or divisions Therefore, their followers also thus make water lifeless by mixing into it ash or lime but this is altogther improper By accepting water made

lifeless in this way, the main purspose is defeated Therefore, monks and nuns of Śvētāmbara idolatrous sect accept only thrice boiled lifeless water and it is called in sanskrit language 'acitta' (अचित्त) i e lifeless water and in Jain canonical scriptural terminology it is called ' prāsuka' (प्रासुक) i e lifeless

There are some people who ask if ash or lime is the only remedy for making various kinds of water lifless - sweet water of rainy season, collected in a small ditches, salty water of wells purified water of the river Ganges etc , mineral water, hot sulphuric water of ditches and all kinds of water They believe there should be different remedial things for various kinds of water But it is their false notion

Jain canonical scriptures show two possibilities how life-containing earth, water etc become lifeless When earth comes in contact with earth of different kind both the kinds of earth become lifless Both the kinds of earth destroy themselves When water is poured into earth, both the water and the earth destroy each other and make each other lifeless Ash is a defiled form (vikāra) of plant and lime is earth Any kind of water can therefore be made lifeless by ash or lime It should, therefore, not be doubted how the same substance makes all kinds of water lifeless

Regarding the use of lifeless water, most of the laypersons use lifeless water only for drinking and for all other purposes they mostly use water that contains life It is enough to tell them that there is lack of power of discrimination Water is a mass of water-lives Therefore the least possible use should be made of water whether it contains lives or it is lifeless For laypersons, water that contains lives is not absolutely forbidden Therefore, there is no objection to drinking water that contains lives but from the view point of hygiene and physical science, it is most beneficial to drink lifeless water

One of the well-established rules of the Jainism is that everyone should drink, if it is possible lifeless water and for the laypersons who are practising penance and for the monks and nuns, there is no exception to this rule According to Jain biology water itself is a living organism

In the present times if a Jain monk or nun or one who is proficient in Jain philosophy or an odinary scientist is asked, "Why is it prescribed in the Jain religion to drink boiled water ?" they all will say that water itself is a living organism and there are various and numerous micro-organisms in it It is

doubted that they produce a number of diseases in the body and such micro-organisms always continue to be produced in water conaining lives The micro-organisms cease to be produced in boiled water We should, therefore, drink water after boiling it Here it may be argued that it is not proper according to Jain philosophy to cause or to stop expansion of family of any person or animal That is also fully sinful Like one who only sees, we should see everything indifferently It is not proper to involve oneself in any activity What right, then, do we have to stop the expansion of somebody's family? For us all, the answer to this question is difficult Boiling water is for us an activity of himsā i e violence, whether we boil it for ourselves or for others

Therefore, the question stands as it was--' Why should we drink water only after boiling it? ' On the basis of modern scientific investigations, this question can be answered as under -

According to the principle of science, there are positively charged particles called cations and negatively charged particles called anions in every liquid and in the water of wells, ponds, rivers, rain etc There is salt and a larger proportion of negatively charged particles Water containing anions make the body very fresh It sometimes produces excessive energy also But when water is heated, it not only becomes lifeless, but also makes the negatively charged particles neutral i e devoid of elecric charge Consequently, heated water does not produce bad mental or physical effects Therefore, only heated water is proper for monks and nuns and for the laypersons who practise penance

As a scientific evidence for this I would like to say that in America and other developed countries special apparatuses have recently come to the market for making the atmosphere of air-conditioned offices etc free from cations or filling it with negatively charged particles, anions i e for ionizing the atmosphere and they are in a great demand The main reason for this is that in air-conditioned places, where cold wind is blowing, no heat is experienced at all Yet workers sit there, they do not feel like working There is physical and mental non-activity Work is, therefore, not done as much as it is expected It has been found on investigation that in air-conditioned atmosphere there is a greater proportion of cations If their number is reduced and the proportion of anions is increased, the atmosphere becomes freshening and energizing On the basis of this research that the ionization appara-

tus is used to a very great extent for negatively charging the air This machine produces and throws off billions of anions every second In the rainy season we experience the tendency of sleeping after taking meals and do not feel like doing anything because in those days, there is a larger number of cations in the atmosphere Not only from the view points of compassion for living beings and hygiene but also from the view point of mental complacency and health, it is, therefore, necessary to drink boiled water All that has been said here is fully scientific

There are some people who say that lifeless water is a cause of many possessions But it is a bad logic It is not proper to say that the instruments necessary for observing non-violence and compassion for lives are possessions Ācārya Śrī Haribhadrasūriji also say this in his 'astaka prakarana'

There are some people who say that all kinds of water available on earth is mixed with some or other kind of earth, ash etc , therefore, it is lifeless Why should it, then be again made lifeless? Pure water is available only in *the laboratory We are non-omniscient We are, therefore not hundred per*cent sure whether this water contains life or it is lifeless Therefore, even if water is naturally lifeless, it should be again made lifeless

There are some people who compare rainy water with water formed from the vapour in the kitchen They say that if rainy water contains life, drops of water attached to the lid of a vessel in the kitchen which are made of vapour, should also be regarded as cotaining lives But this is a wrong belife Superficially looking both these processes seem to be similar but in fact the difference between them is veery great

'Jīvavicāra Prakarana ' composed by Ācārya Śrī Śāntisūriji in the twelfth century of Vikram Era and Jain canonical scriptures such as 'Jīvābhigama' etc mention the rainy water as life containing water Perhaps sometimes *there are fishes also* in the rainy water Therfore, rainy water should not be believed as lifeless water Generally, in Gujarat and also in other states laypresons filter the water in the early morning once a day, that contains life The treatise 'Pravacana Sāroddhāra ' (verses 881-882) of the Śvētāmbara tradition states that the thrice boiled lifeless water becomes life containing *after 15 hours in summer* 9 hours in monsoon and 12 hours in winter The verse is as under -

जायइ सचित्तया से, गिम्हंमि पहरपंचगस्सुवरिं। चउपहरोवरि सिसिरे, वासासु पुणो तिपहरुवरि ॥८८२॥

jāyai sacittayā sē, gimhammi paharapañcagassuvarim
caupaharōvari sisirē, vāsāsu punō tipaharuvari 882

And therefore, the water turned into drops from vapour in the kitchen is lifeless because it has not crossed the prescribed time limit, while the rainy water, after being transformed into water crosses the prescribed time limit Scripturists say that the rainy water contains lives Similarly, the distilled water produced in the laboratory, which doctors use for injections also contains life, though it is extremely pure

Minute water drops that are produced by vapour present in the atmosphere and attached to the external surface of the vessel containing ice and such other things which are cooled in the refrigerator, are not acceptable to monks and nuns and laypersons who abstain from things that contain life, even though it is lifeless because for that water drops, ice which has life containing water bodies and things cooled in the refrigerator are mixed with it No question, therefore, arises for accepting minute water drops produced through the contact of ice etc

In the end, the question arises that as we make water lifeless, so we should also make air lifeless because according to Jain scriptures air also contains life But this is not logical Though water and air are very indispensable to human life, there is a tremendous difference between their forms Therefore, if we apply to air whatever we apply to water, it will show our intellectual bankrupcy Therefore, no solution is necessary here

In short all monks and nuns and laypersons, moreover all persons who want to pass healthy life, have to use the thrice boiled water

THE PROBLEMS OF LANGUAGE HERE ARE REALLY SERIOUS WE WISH TO SPEAK IN SOME WAY ABOUT THE STRUCTURE OF THE ATOMS BUT WE CANNOT SPEAK ABOUT ATOMS IN ORDINARY LANGUAGE

W HEISENBERG

29. Jainism And Science: Solutions Of Some Problems

In the present age, science has become an essential component of human life Every man, therefore, looks at a problem in a scientific manner and tries to find its solution with a scientific method Though a number of scientific principles are found in Jain scriptures, there are many present-day problems on which science and Jain scriptures clearly differ

We shall discuss here some such problems

Length/Height of Living Beings

The 'Tristhiśalākāpurusacaritra' written by Śrī Hēmacandrācāryajī (V Era 1145-1229) is an unique work among Jain mythological works (Purānas) Many historical references are found in its 'Pariśista Parva ' In this work he has elaborately described the lives of sixty three great men The heights of body of all of them is given in Jain scriptures

According to this book, the height of body of Bhagavān Rsabhadēva was 500 Dhanusyas (1 Dhanusya= 6 feet) One Dhanusya is equal to 4 hands Taking one hand to be equal to one and half feet, the height of the body of Bhagavān Ādinātha (Rsabhadēva) measures 3000 feet In the same way the height of the body of Bhagavān Śāntinātha measures 40 Dhanusyas i e 240 feet The height of the body of Bhagavān Mahāvīra was seven hands i e ten and half feet Today we don't believe all this to be true but we should very well bear it in mind that not a single principle of science is unchangeable The principles that have been proved today to be true, can be proved tomorrow to be untrue

Recently, Carl Sagan, an American scientist, has developed a cosmic calendar It is very similar to Jain time cycle According to scientists, the Earth was produced out of the Sun nearly four and half thousand million years ago They have contemplated the period from this incident to the incident of the destruction of the whole universe to be of 12 months i e 365

days and the calendar of the period shows date-wise record of the incidents that took place during the period It fits in with the time-cycle of Jainism I have made all this analysis in my article captioned , 'The Jain Time Cycle and Cosmic Calendar '

Only a few years ago, the American science magazine entitled 'Discover' presented photographs of fossils of birds with 11 5 feet long and 23 feet broad wings

Science has been searching the gigantic living world of ancient times and has procured fossils of gigantic animals such as the dinosaur On the basis of these fossils, scientists believe that the height of their body was at least 150 feet and their existence belonged to an age prior to 7 crore years

The Jain biology places the dinosaur in the one part of phylum reptiles called Bhujahparisarpa The mongoose etc of the present times belong to the same phylum According to the Jain scriptures, namely, the Jīvābhigama, the Pannavanā etc , the utmost height of these living organisms varies from two Gāus (1 Gāu = 3 2 km) to 9 Gāus If the utmost height of the dinosaur was 2 Gāus , the utmost height of man was 3 Gāus in those times According to this calculation, the height of dinosaur is 2/3 of the height of man If one Dhanuṣya is equal to six feet, the height of the dinosaur determined on the basis of the fossils is 25 Dhanusyas and the height of man of those times was 37 5 Dhanusyas Man of this height lived in the times of Bhagavān Śāntinātha, the sixteenth Tīrthankara and according to the calculation of time-cycle these times were prior to three Sāgarōpamas

Though there is an appreciable difference between three Sāgarōpamas years and 7 crore years, we can say it beyond doubt that the inference of 7 crore years is wrong because the method with which the antiquity of ancient fossils is determined seems to be wrong method This method used the isotopes of carbon-14(C-14) Regarding this method it is written in the book entitled 'The pyramid Power' -

"*Unfortunately, it now appears that the dates obtained through the use of this method are highly questionable, since contamination from present day organic materials could substantially affect the process Archaeologists now believe that most of the sites dated with carbon-14 are older than the dating process showed that they were There is currently an*

enormous controversy ranging in archaeological circles over the claim of some archaeologists that carbon-14 dating is incorrect by thousands of years, not hundreds of years as was previously thought " (p 20)

From this reference we can say that in determining the time of ancient fossils according to this method miscalculations of not hundreds or thousands of years but of lacs of years has been made Therefore, the fossils which we believe, according to this can be at least three or four hundred thousand years old can be at least 3 or 4 thousand million years old Therefore, the possibility that the dinosaurs belong to the times not prior to 7 hundred million years but to the time of three Sāgarōpama years, should not be ruled out

Similarly, it is not proper to entertain any doubts about the hight of the great men On the contrary, it is necessary to prove this in a scientific way

Bulbous roots

A number of questions are raised about bulbous roots i e modifications of roots It is said that if there were micro-organisms in bulbous roots they would certainly be seen through a microscope as bacteria are seen in curds But this is a very wrong belief Bacteria etc being two-sensed organisms can be seen distinctly in a state of motion in curds But the plant itself is a living being and, therefore, there is no question of seeing micro-organisms in it through a microscope The plant kingdom is of two types

1 Pratyēka Vanaspatikāya (having a single soul in a single body of plant, seed, root, flower, leaves and fruit) and 2 Sādhārana Vanaspatikāya (having infinite souls in a single body or cell of a plant) In Pratyēka Vanaspatikāya every soul has his own independent body and in Sādhārana Vanaspatikāya, infinite souls have only a single common body It means that there are infinite souls in a single body or cell The fruits, flowers, leaves, roots etc that we see make the body of the plant lives Can soul be seen as different from the body through a microscope? According to modern science every living being has basic cells of body Billions of such cells join together and make the body of a living organism or an animal Again every cell is a living cell Not only all the cells of potatoes etc are living cells but also every cell has infinite lives i e souls in it That is why bulbous roots are regarded as unfit to be eaten

Another question also arises If favourable conditions for life are removed from the place where there is multitude of living organisms, the multitude of living organisms will die There will be decaying and the vegetables will not last for a long time But bulbous roots remain fresh for use for a long time If they have lives, they can remain protected underground If they are taken out of earth, living organisms die and decaying will begin But these beliefs are entirely wrong Bulbous roots do not become lifeless after they are taken out of the ground They continue to retain life for a long time after they have been taken out of the ground There are only two ways to make the bulbous roots lifeless It becomes lifeless by means of weapons such as knife etc With a knife they should be cut into pieces or they should be cooked on fire

It should also be noted that after living organisms i e souls have ended up, they do not decay as a rule In order to preserve dead bodies for a long time, the dehydration technique was adopted in ancient Egypt and it is also adopted in modern times and the mummies found from pyramids of ancient Egypt are a testimony to it Even after lives in bulbous roots have ended up, if they are dehydrated, they do not decay, e g ginger After lives have ended up in ginger, it automatically get dehydrated But potatoes etc do not automatically get dehydrated They get dehydrated only after they have been cut with knife etc Therefore, dry ginger is fit to be eaten but potatoes etc are not fit to be eaten even after they have become dry

It can also be argued that micro-living beings are found in non-bulbous roots but bulbous roots are quite clean, when they are cut But here it needs to be noted that Jain scriptures say that it is a characteristic of Sādhārana Vanaspatikāya (having infinite souls in a single body or cell of a plant) that when it is cut, it is cut in regular pieces and there are no fibres and knots nor do leaves have veins Really speaking, in scientific terminology, bulbous roots are a modifications of roots Bulbous roots therefore, cannot become fit to be eaten just because they are neat or clean

Purity of life or character or conduct depends on purity of food Purity of food is therefore necessary The potato, the radish etc are Sādhārana Vanaspatikāya It is, therefore, best to abstain from them There are some people who argue that there cannot be any reference to potato in our ancient scriptures because it is originally not a product of India In 1586 A D Sir William Raleigh brought it to England from South America (Brazil) Later

on about 1615 A D it came to India A reference to it in ancient scriptures is, therefore, impossible On this ground they say that it is not a statement made by Omniscient God that 'The potato is an Anantakāya or Sādhārana Vanaspatikāya' but it is rule made by nescient (chadmastha) But this argument is not proper

It is not possible for scriptures to talk of all kinds of plants, Anantakāya and animals etc Scriptures only give characteristics and some names of Anantakāyika plants On the basis of their characteristics our ancient sages have shown that potato etc are Anantakāya The tomato, the apple etc too are not products of India and nowhere do the scriptures talk of them Our scripturists of later times have not prohibited them because they do not show the characteristics of Anantakāya

It was a tradition of our ancient sages that they never wrote anything against scriptures They also observed the rule that nothing should be written without a reference or basis and they had no reason to make statements that were not true They were more learned and more sin-fearing than we are Their statements, therefore, are not unacceptable simply because they were not omniscient

Another question may be raised that if we are prohibited to eat bulbous roots, how are we justified in eating dry ginger and dry turmeric? How can we be allowed to eat them even if they are dry? This is an excellent question When ginger and turmeric are green, they are no doubt Anantakāyas Later on when they dry up, they automatically become lifeless and knives and other instruments are not needed in order to dehydrate them But the potato does not become dry naturally or automatically If the potato is kept somewhere in sunlight for a long time, in a few days, it begins to decay If it is to be dehydrated, it should be cut into small and fine chips Then they become lifeless As food, potatoes are used in a great quantity It is not proper to kill those infinite lives or living beings for our sake The potato is, therefore, prohibited for us Ginger and turmeric are not food In a very small quantity they are used as medicine to add to the quality of food They are, therefore, acceptable The dry potato is, therefore, altogether unfit to be eaten but ginger and turmeric are fit to be eaten after they become dry

Another question may arise Is ground-nut a bulbous root or not? Really speaking, though a ground-nut grows underground, it is not regarded to be

a bulbous root because the upper husk of a ground-nut has fibres Unlike the parts of other bulbous roots, every organ of a ground-nut cannot produce a new plant nor can its pieces produce a new plant, whereas pieces of a potato etc can produce new plants Thus no characteristics of Sādhārana Vanaspatikāya or Anantakāya are found in ground-nut The ground-nut is, therefore, fit to be eaten

Multi-seeded vegetables ·

A question may also be raised about multi-seeded vegetables like brinjal There are some people who ask that if the brinjal, the fig etc are unfit to be eaten because they are multi-seeded Are not ghosby, musk-melon (kind of vegetables) cucumber, round gourd also multi-seeded ? This question demands a lot of thinking After thinking about multi-seeded vegetables, it has been found that the vegetable is not unfit to be eaten simply because it is multi-seeded The kind of seeds of multi-seeded vegetable is the determining factor There are two kinds of seeds Some seeds become lifeless while being cooked and some seeds do not become lifeless while being cooked The seeds of brinjal guava etc do not become lifeless while being cooked and figs are eaten uncooked and, therefore, they are not fit to be eaten The seeds of ghosby, musk-melon, cucumber lady's finger etc become lifeless while being cooked They are, therefore, fit to be eaten According to the book 'Dharmasangraha' the seeds of multi-seeded vegetables do not have a subtle transparent cover on them This is a main characteristic of multi-seeded vegetables The vegetables, namely ghosby, cucumber, lady's finger etc have a subtle transparent cover on their seeds They are, therefore, not considered as multi-seeded

Another point to be noted is that researches of modern science show that brinjals have more toxic substance than other vegetables For that reason also brinjals should not be eaten

It is true that many uncertainties prevail among us about foods that are fit or unfit to be eaten because they are classified by those who are non-omniscient We should, therefore, think about this in a scientific way in this scientific age About foods that are fit or unfit to be eaten, we, the monks of new generation, think only in a scientific way We, therefore, invite such questions We shall try to solve them as best as we can I hope that this logical

solution will prove to be satisfactory

In Jain tradition carefulness (Yatanā) is a main characteristic of religious activity In the ' Daśavaikālika Sūtra' when the disciple is taught that himsā, i e violence is committed even in walking, standing, sitting, sleeping, speaking and eating, the disciple asks how one can live one's life if himsā, i e violence is committed even in walking, standing, sitting, sleeping, speaking and eating ?

कह चरे ? कह चिट्ठे ? कहमासे ? कह सए ? कह भुंजतो ? भासंतो ? पावकम्म न बंधइ ?
(दशवैकालिकसूत्र अध्ययन-४, गाथा ७)

kaham carē ? kaham citthē ? kahamāsē ? kaham saē ?
kaham bhuñjantō ? bhāsantō ? pāvakammam na bandhai ?

(Daśavaikālikasūtra Adhyayana-4, Gāthā - 7)

It is said in reply to this -

जय चरे, जय चिटठे जयमासे जयं सए । जयं भुंजंतो भासतो पावकम्म न बधइ ।

(दशवैकालिकसूत्र अध्ययन ४ गाथा ८)

jayam carē jayam citthē jayamāsē jayam saē
jayam bhuñjantō bhāsantō pāvakammam na bandhai

(Dasavaikālikasūtra Adhyayana-4 Gāthā - 8)

Walk with care, stand with care, sit with care, sleep with care, speak with care and eat with care so as not to commit sin

Thus carefulness is important in the Jain religion Scripturists teach us to live a life of least sinful activities and this can be done by observing utmost carefulness

Genders of living beings

A question also arises about genders of living beings According to Jain scriptures one-sensed two-sensed three sensed and four-sensed living beings belong to neuter gender and they reproduce asexually But science (botany and zoology) shows that this is wrong Zoology shows that ants, flies, butterflies etc undergo sexual intercourse and they produce offsprings with a gender Among them there are genders of males and females Botany shows that there are male and female genders even among trees and plants

also Then what is the reality regarding the classification of genders of living beings according to Jain philosophy?

This is a good question But in order to find an answer to it, we should, properly, minutely and elaborately study and contemplate on Jain scriptures First of all, we should coordinate from various view-points, mutually contradictory statements found in Jain scriptures Talking of genders of all living beings in the whole universe Vācaka Umāsvāti, well versed with Pūrvas , the author of Tattvārtha Sūtra says in the second chapter of the Tattvārtha Sūtra that " नारकसमूर्च्छिनो नपुंसकानि ।।५१।। न देवा ।।५२।। " *nārakasammūrcchinō napumsakāni 51 na dēvāh 52* Living beings born in hellish Yōni and all living beings born asexually belong to the neuter gender No god belongs to the neuter gender All celestial beings (gods) belong either to the genders of the gods (males) or goddesses (females) Embryonic human beings and other five-sensed embryonic beasts have any of the three genders

The Tattvārtha Sūtra shows three types of birth (1) sammūrcchima janma (asexual birth) (2) garbhaja janma (sexual birth) (3) upapāta janma (asexual birth of celestial and hellish beings) Celestial and hellish beings are born only asexually The sexual birth is of three types- (1) jarāyuja - birth with wrapper which contains blood (2) andaja - birth through eggs (3) pōtaja- birth without a wrapper Human beings, cows, buffaloes, horses, deer etc are born with wrapper containing blood Snakes, cuckoos, fishes, tortoises etc are born through eggs The goose, the parrot, the pigeon, the hawk, the crow, the peacock etc are also born through eggs The mongoose, the hare, the mouse etc and the vampire, the bat, etc are born without a wrapper and they all are five-sensed Apart from these, one-sensed to four-sensed living beings are all asexual i e sammūrcchima

On the other hand, the 'Kalpasūtra' edited by Śrutakēvalī Caturdaśapūrvadhara Ācārya Śrī Bhadrabāhusvāmi describes five types of subtle eggs -

से किं तं अडसुहुमे ? अडसुहुमे पंचविहे पण्णत्ते तं जहा - उद्दसडे, उक्कलियंडे पिपीलियंडे हलियडे, हल्लोहलियडे । (कल्पसूत्र, सामाचारी)

sē kim tam amdasuhumē ? amdasuhumē pañcavihē pannattē tam jahā - uddamsandē, ukkaliyandē, pipīliyandē, haliyandē, hallōhaliyandē

(Kalpasūtra, Sāmācārī)

Which are the subtle eggs? The subtle eggs are of five types 1 Uddamśaṇḍa- those of butterfly, a bug, i e a matkuna etc 2 Utkalikānda - those of spider 3 Pippilikakāṇḍa- those of an ant etc 4 Hallikāṇḍa - those of a lizard etc 5 Hallōhallikānda - those of a chameleon etc

On the one hand, there is a statement of Vācaka Umāsvāti and on the other hand, there is a statement of Ācārya Śrī Bhadrabāhusvāmi Both these statements are mutually contradictory But we should bear it in mind that both these statements are made from different points of view Therefore, thinking from the real point of view (निश्चयनय), we find that the statement of Vācaka Umāsvāti is true and from the practical view point (व्यवहारनय) the statement of Ācārya Śrī Bhadrabāhusvāmi seems to be true because though the insects namely, the ant, the fly, the bug are asexual and, therefore, of neuter gender, they emit such substances out of their body as are generally known by people as eggs Now the only question that arises is this If they belong to the neuter gender, how do they indulge in sexual intercourse of a male and a female?

All living beings have four instincts, expressed or unexpressed They are 1 food 2 fear, 3 sex, 4 covetousness At some places, scriptures say that there are ten instincts and they also include these four instincts Therefore, all living beings whether they are males, females or neuter beings, have the sex instinct Therefore all living beings of Samsāra (universe) indulge in sex activities But in celestial beings and hellish beings, these sex activities do not cause reproduction Similarly, all living beings, from the one-sensed to the four-sensed, indulge in sexual activities which do not cause reproduction

According to the Jain canonical treatises namely, Karmagrantha, Karmaprakrti etc a male's desire for copulation is like a fire laid on grass his desire for sex is soon satisfied Female's desire for copulation is like a fire covered with ashes She takes a long time in satisfying her sex desire A neuter being's desire for copulation is like a fire laid on a great city His desire for copulation is never satisfied The sex instinct is, therefore, most active in neuter beings Sometimes, the dissatisfaction of sex, causes their death, e g the death of a butterfly

"The Manusmrti " says " स्वेजाः कृमिदंशाद्याः (svējāh krmidamśādyāh) " It means that two-sensed, three-sensed and four-sensed living beings are born

in their excreta, urine, sweat etc Therefore, we take the substances emitted by them for eggs and that is our wrong belief

In the ' Jñāna-Vijñāna Pūrtti' supplement of 'Sandesh'(July, 8, 1987), a daily newspaper, published from Ahmedabad, it has been recently said about the lizard that 'the whip-tail lizard' found in south-west America and north Mexico, is only the female lizard

Prof David Fuze has made experiments on it He kept two female lizards in a cage One of the lizards behaved as a male and the other lizard behaved as a female Eggs were got from the lizard which behaved as a female, but after ten or fifteen days, the roles were interchanged The lizard which behaved as a female, began to behave as a male and the lizard, which behaved as a male began to behave as a female

The photograph shown in 'Sandesh' show sexual intercourse between two lizards having sex organs of the same gender This proves that sexual activities between lizards do not cause reproduction

The 'Tattvārtha Sūtra' names the lizards as 'the domestic cuckoo' (गृहकोकिला) and places it in the class of five-sensed Tiryañcas, i e beasts and birds, born without a wrapper Along with it, such other insects as the chameleon (which changes color according to the surroundings) and the iguana (which is like the lizard) are also placed in this category On the other hand, well -versed in fourteen pūrvas (the Jain canonical treatises), Śrī Bhadrabāhusvāmi mentions in the Kalpasūtra that Hallōhallikā and Hallikā i e the lizard and the chameleon lay subtle eggs The question, therefore, arises whether the lizard and the chameleon are four-sensed or five-sensed? We have no scriptural solution of this Scholars are, therefore, requested to send scriptural solution, if they know any

Different Kind of Pudgala (Matter)

Pudgala i e matter is of four kinds (1) Skandha (physical aggregate), (2) Dēśa (part of physical aggregate), (3) Pradēśa (constituent unit) and (4) paramānu i e the most micro undividable unit (atom) Pudgala-skandhas i e physical aggregates are of six kinds 1 extremely gross (Bādara-Bādara) 2 gross (Bādara) (3) gross- subtle (Bādara-Sūksma) 4 subtle-gross (Sūksma-Bādara) 5 subtle (Sūksma) 6 extremely subtle (Sūksma-Sūksma) All agree that there are these six kinds But the problem is related to their examples

There are some who say that Jain scripturists classify air as subtle-gross and they classify light as gross-subtle But modern scientists have proved that light particles are very much subtler than air particles and the contention of Jain philosophy is, therefore, not proper and the kinds of a pudgala- skandha (material aggregates) should be re-examined

All is well and proper with the four kinds of the pudgala- skandha namely, 1 extremely gross, 2 gross, 3 subtle and 4 subtle-subtle We need to think about only gross-subtle and subtle-gross A statement of Jain scriptures always refers only to a particular point of view From another point of view, it may be wrong But it is not wrong from all points of view

Air is classified as subtle-gross and light is classified as gross-subtle Here the statement of the scripturists is only relative After a considerable pondering, one comes to the conclusion that air and light are properly classified By light, some mean light- particles/photons and by air, some mean molecules of oxygen, nitrogen etc But that is not the fact Air means air-bodies We can take air molecules as air bodies but this is not true of light The word light should be taken to mean light-bodies because they are made of aggregates of material particles i e Audārika Varganā, Thinking thus we conclude that fire itself can be in grouping of Audārika Varganā the particles/photons emerging from it, can be different from it They can be included in grouping of Taijas Varganā It should be noted here that there is vast difference between a light-body (fire) and photon particles In both of them, the light particles/photons are very much subtler than light- bodies

If from practical point of view, we contend that this classification of material aggregates refers to light-bodies and air- bodies, this classification sounds to be true With our eyes, we can clearly see fire, and if we touch it, we feel its heat When air is in motion, it can be perceived through touch only It is therefore proper that fire (not light, but the flame etc that produce light) is classified as gross-subtle and air is classified as subtle-gross

30. Some References To Human Physiology In Jain Scriptures

In Jain scriptures we get information about different subjects like Physics, Mathematics, Biology, Geography and Cosmology Similarly we also get *some references to Human Physiology i e the physical structure of human* body

Jain scriptures on Karma-philosophy such as Karmagrantha of Śrī Dēvēndrasūri, Karmaprakrti of Upādhyāya Srī Yaśōvijayajī and cosmological treatises like Lōkaprakāśa and Brhatsangrahanī give us an idea of different types of bone-joints [1] The technical word, used in the Jain scriptures for bone-joints, is Sanghayana The names of bone-joints are as follows (1) Vajra-Rsabhanārāca (2) Rsabhanārāca (3) Nārāca (4) Ardhanārāca (5) Kīlikā and (6) Sēvārtta

In the first bone-joint, Vajra-Rsabhanārāca there are two Markata-bandhas, one bandage and a bone-pin Two Markata-bandhas are surrounded by a bandage of bone and a bone-pin passes through the bandage and two bones which are joined (fig 1) Except a bone-pin, the second bone joint Rsabhanārāca Sanghayana is just like the first bone-joint (fig 2) The Third bone-joint, Nārāca is formed by only two Markata-bandhas (fig 3) while in the fourth bone-joint Ardhanārāca, there is only one Markata-bandhas (fig 4) In the fifth bone-joint Kīlikā, two bones are joined with a bone-pin (fig 5) And in the last i e the sixth Sēvārtta Sanghayana bones are attached to each other as shown in the figures 6 (A), (B) and (C)

According to the Jain treatises, at present we all possess the last Sēvārtta Sanghayana [2] and that is why our bones move from their original position with a slight jerk The first Sanghayana is the strongest bone-joint, while the last Sanghayana is the weakest bone-joint Jain scriptures describe that the stronger the bone-joint, the better or worse work can be done by the animals or men So only a possessor of the first type of bone-joint, i e he, who has Vajra-Rsabhanārāca Sanghayana, can free himself from the bondage of karma i e he can attain emancipation, and due to

Fig 1 Vajrarṣabhanārāca

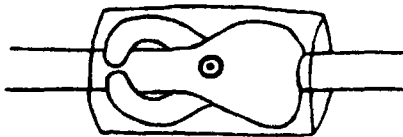



Fig 2 Ṛṣabhanārāca

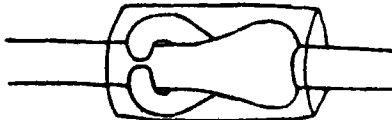



Fig 3 Nārāca

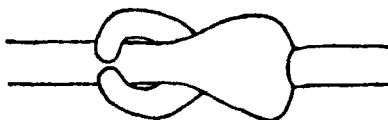
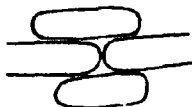



Fig 4 Ardhanārāca

Fig 5 Kīlika

Fig 6 Sevarta

the worst actions he even goes to the seventh hell also [3] Similarly all men, with different types of bone-joints, have different bearing power Kalpasūtra approves that only Lord Mahāvīra could endure the great calamity caused by god Sangama, because he had the first type of bone-joint [4]

Lōkaprakāśa (part III) and Brhatsangrahanī mention that the number of ribs of a man's (human) skeleton during the first, second and third sub-divisions (ārās) of the second half of the time-cycle (Avasarpinīkāla) and the sixth, fifth and fourth sub-divisions (ārās) of first half of the time-cycle (Utsarpinīkāla) is 256, 128 and 64 each and the height of their bodies is 3 Krōśas, 2 Krōśas and 1 Krōśa respectively [5] So we conclude that in Avasarpinīkāla , the number of ribs decreases as time passes And so at present we possess only twelve ribs

Tandulavēyāliya Payannā and Pravacana Sārōddhāra give details of human biology of the present time [6] There are twelve ribs They arise from the twelve joints of the back-bone of human body and join with the breast-bone, to form a cage There are also six half-ribs hanging on each side of the back-bone Technically they are called Katāha Without any bone, a tongue is seven angulas long and its weight is 4 palas The weight of each cornea is 2 palas There are four parts of the skull, each is called Kapāla The weight of flesh, in the cavity of the chest-cage, perhaps lungs, is 3 5 palas, while the heart's weight is 25 palas There are 160 bone-joints in our body and two intestines, a small one and a large one, each weighing five Vāmas The small intestine is long but thin and the large intestine is short but thick

Tandulavēyāliya Payannā and Pravacana Sārōddhāra mention that generally men, women and impotents possess 700, 670 and 680 veins respectively Their situation is as follows

160 veins going upwards from the navel (Ūrddhvagāminī)

160 veins going downwards from the navel (Adhōgāminī)

160 veinks going oblique on both sides of the navel (Tiryaggāminī)

160 veins going downwards to anus (Adhōgāminī Gudā Pravista)

025 veins possessing mucus or mucus (Ślēṣmadhārinī)

025 veins possessing bile (Pittadhārinī)

010 veins possessing semen (Śukradhārinī)

The speciality of the Yōni (female organ) has been described in the ninth chapter of the Pannavanāsuttam[7] and in the third chapter of the Thānangasuttam It is of three types (1) Kūrmōnnatā, (2) Śankhāvartta and (3) Vamśīpatrā The terms denoting these three types of Yōni are descrptive and self-explanatory The term Kūrmōnnatā suggests its tortoise like curve, the term Śankhāvartta suggests its conch like coiled shape and the term Vamśīpatrā suggests its resemblance to bamboo leaf

The Kūrmōnnatā Yōnis give birth to great personalities such as Tīrthankaras, Cakravartīs and Vāsudēvas Strīratna (Chief queen of Cakravartī) has invariably the Śankhāvartta Yōni Many living beings descend to this Yōni but they invariably die before their actual birth That is, none is born from this Yōni Ācārya Malayagiri records an old view that Strīratna's embryo gets destroyed on account of excessive heat of her sex passion (Prajñāpanā-Tīkā, folio 228 A) Generally women have Yōnis of Vamśīpatrā

We find in the Bhagavatīsūtra (Śataka-2, uddēśaka-5), the Pravacana Sārōddhāra (p 296) and the Tandulavēyāliya Payannā that on account of gaseous trouble or if some devil makes the embryo stable, it could live for 12 years at the most After that period the embryo dies or takes a birth through a vulva [8]

On account of sinful actions of previous births one could live as an embryo for a maximum period of 24 years by descending again to the same embryo after the first twelve years [9] In Jain treatises, technically it is called Kāyasthiti of embryo

Tandulavēyāliya Payannā and Vicāraratnākara of Srī Kīrtivijaya Upādhyāya describes the developing process of human embryo during different months of pregnancy [10] In the first week of pregnancy sperms and blood combine to form a liquid solution and in the second week it becomes more solid, in the third week tissues multiply in number At the end of the first month, the weight of the embryo rises to three Karsas i e 48 Māsās or 240 Guñjās During the second month, the embryo looks like a cubic piece of tissues and develops into a more solid form In the third month the mother desires particular things because of the embryo During the fourth month of pregnancy, different parts of the mother's body such as mammary glands get nourished In the

fifth month, formation of two hands, two feet and a head takes place In the sixth month, blood and bile are formed and during the seventh month 700 veins, 500 functional cavities, 9 main pipes (dhamanīs) take their shapes At the end of the seventh month construction of 99 lakhs of hair-holes and 3 5 crores of hair take place During the last month the embryo becomes completely ready for independent life

Tandulavēyāliya Payannā and Vicāraratnākara show that if the embryo is on the right side in the womb of the mother, its modification takes place as a boy or male and if the embryo is on the left side in the womb, it becomes a girl or female [11]

We find the reproductive period of men and women during life time in Pravacana Sārōddhāra and Tandulavēyāliya Payannā If the longevity is of a hundred years, mostly men and women can reproduce a child from 16 years to 75 years and from 12 years to 55 years respectively [12] The developing time for human embryo is 277 days approximately and Kalpasūtra also approves of this fact by giving the developing period of Tīrthankaras' embryo in their mother's womb [13]

Fertilization of an egg with a sperm i e descending of soul to a woman's womb takes place within 12 Muhūrttas i e 9 hours and 36 minutes after the copulation of man and woman within 12 days after the menstruation period [14]

Even though the menstruation cycle in woman's body and the reproduction of sperms in man's body start at the age of 12 years and 16 years respectively, they become capable to reproduce a healthy and well-developed child at the age of 16 years and 20 years respectively [15]

After giving an anatomical idea about the human body and embryology the authors of Jain scriptures give us the sermon that we have got a precious human life as a reward of auspicious deeds of previous births and after bearing great sufferings in our mother's womb So, we should use this precious life for emancipation of soul by doing good actions and attaining spiritual knowledge Otherwise our precious human life becomes meaningless

(Jain Journal, July 1986)

References

1 • सघयणमट्ठिनिचओ त छद्धा वज्जरिसहनाराय ।
तह रिसहनाराय नाराय अद्धनाराय ॥३८॥
किलिअ छेवटठ इह रिसहो पटटो अ किलिआ वज्ज ।
उभओ मक्कडबधो नाराय इमभुरालगे ॥३९॥

sanghayanamatthinicaō, tam chaddhā vajjarisahanārāyam
taha risahanārāyam nārāyam addhanārāyam 38
kilia chēvattham iha risahō pattō a kiliā vajjam
ubhaō makkadabandhō nārāyam imamurālangē 39

• [The first Karmagranth of Sri Dēvēndrasūriji Verses 38 and 39]

• Lōkaprakāśa of Śrī Vinayanijayaji part-1 Sarga-3 Verses 398 to408

• Brhatsangrahanisūtra of Śri Candrasūriji Verses159 160

• Karmaprakrti Commentary on the first verse by Śri Yasōvijayaji

2 सपइ खलु आउसा । मनुयाण छवठ्ठ सघयण वट्टइ ।

sampai khalu āusō ! manuyānam chēvaththē sanghayanē vattai

[Tandulavēyāliya Payannā P 27]

3 छेवट्ठण उ गम्मइ चउरा जा कप्प किलियाईसु ।
चउसु दु दु कप्पवुड्ढी पढमण जाव सिद्धो वि ॥१६२॥
दो पढम पुढवी गमण, छवट्ठ किलियाइ सघयणे ।
इक्किक्क पुढवी वुड्ढी ॥२५५॥

chēvatthēna u gammai caurō jā kappa kiliyā su
causu du du kappavuddhi padhamēnam jāva siddhō vi 162
dō padhama pudhavi gamanam, chēvatthē kiliyāi sanghayanē
ikkikka pudhavī vuddhi, 255

[Brhatsangrahanisūtra of Sri Candrasūriji Verses162 and 255]

4 Kalpasūtra Subōdhikā Commentary by Śri Vinayavijayaji Sixth part

5 • Commentary on Brhatsangrahanisūtra verses- 3 & 4

• Lōkaprakāsa of Śri Vinayavijayaji part-3 Sarga-29 Verses 178-276 277 284

• Tandulavēyāliya Payannā P 26-A

• Kālasaptatikā Prakarana Verse-10

6 • आउसो । अणुपुव्वेण अटठारस्स य पिटठकरंडगसधिओ बारस पसलिया करंडा, छप्पसुलिए कडाहे चउ पलिया जिब्भा, दु पलियाणि अच्छीणि चउकवाल सिर सत्तगुलिया जीहा अद्धुटठपलिय हियय, पणवीस पलाइ कालिज्जं दो अता पचवामा पण्णत्ता - त जहा थूलते य १ तणुयते य २ आउसो । इममि सरीरए सटिठ सधिसय सत्तसिरासयाइ आउसो । इममि सरीरए सटिठसिरासय नाभिप्पभवाण उडढगामिणीण आउसो । इममि सरीरए सटिठसिरासय नाभिप्पभवाण अहोगामिणीण आउसो । इममि सरीरए सटि्ठसिरासय नाभिप्पभवाण तिरियगामिणीण आउसो । इमस्स जंतुस्स सटिठसिरासय नाभिप्पभवाण अहोगामिणीण गुदप्पविटठाण आउसो । इमस्स जतुस्स पणवीस सिराओ पित्तधारिणीओ पणवीस सिराओ सिभधारिणीओ दस सिराओ सुक्कधारिणीओ सत्तसिरासयाइ पुरिसस्स तीसूणाइं इत्थीयाए वीसूणाइ पडगस्स

āusō ¹ anupuvvēnam atthārassa ya pıtthakarandagasandhıō bārasa pamsalıyā karandā chappamsulıē kadāhē, cau palıyā jıbbhā, du palıyānı acchını, caukavālam sıram sattangulıyā jıhā, addhutthapalıyam hıyayam, panavisa palāım kālıjjam dō amtā pañcavāmā pannattā - tam jahā thūlantē ya 1 tanuyantē ya 2 āusō ¹ ımammı sarıraē satthı sandhısayam sattasırāsayāım āusō ¹ ımammı sarıraē satthısırāsayam nābhıppabhavānam uddhagāmınınam āusō ¹ ımammı sarıraē satthısırāsayam nābhıppabhavānam ahōgāmınınam āusō ¹ ımammı sarıraē satthısırāsayam nābhıppabhavānam tırıyagāmınınam āusō ¹ ımassa jantussa satthısırāsayam nābhıppabhavānam ahōgāmınınam gudappavıtthānam āusō ¹ ımassa jantussa panavısam sırāō pıttadhārınıō, panavısam sırāō sımbhadhārınıō dasa sırāō sukkadhārınıō, sattasırāsayāım purısassa tısūnāım ıtthıyāē visūnāım pandagassa [Tandulavēyālıya Payannā P 35-36 A]

• अटठारसपिटठकरडयस्सा सधीउ हुति देहमि ।
बारस पसुलियाकरडया इह तह छ पसुलिए ।।६८।।
होइ कडाहे सत्तगुलाइ जीहा पलाइ पुण चउरो।
अच्छीउ दो पलाइ सिर तु भणिय चउक्कवाल ।।६९।।
अद्धुटठपल हियय । कालेज्जय तु समए पणवीस पलाइ निदिटठ ।।७०।।
अताइ दोन्नि इहय पत्तेय पच पच वामाओ । सटिठसय सधीण ।।७१।।
सटिठसया अन्नाण वि सिराण अहोगामीणीण तहा ।।७३।।
सटिठसया सिराण नाभिप्पभवाण सिरमुवगयाण ।
अवराण गुदपविटठाण होइ सटिठसया तह सिराण ।
तिरियगमाण सिराण सटिठसया होइ अवराण ।।७६।।
पणवीसा सिभधारिणीओ ।।७७।।

सह पित्तधारिणीओ पणवीस दस य सुक्कधारिणीओ ।
इय सत्त सिरासयाइ नाभिप्पभवाण पुरिसस्स ।।७८।।
तीसूणाइ इत्थीण वीसूणाइ हुति सढस्स ।

atthārasapıtthakarandayassa sandhīu huntı dēhammı
bārasa pamsulıyakarandayā ıha taha ccha pamsulıē 68
hōı kadāhē sattaṅgulāım jīhā palāı puna caurō
acchīu dō palāım sıram tu bhanıyam caukkavālam 69
addhutthapalam hıyayam
kālējjayam tu samaē panavīsa palāım nıdıttham 70
amtāım dōnnı ıhayam pattēyam pañca pañca vāmāō
satthısayam sandhīnam, 71
satthısayam annāna vı sırāna ahōgāmīnına tahā 73
satthısayam sırānam nābhıppabhavānam sıramuvagayānam
avarāna gudapavıtthāna hōı satthısayam taha sırānam
tırıyagamāna sırānam satthısayam hōı avarānam 76
panavīsam sımbhadharınīō 77
taha pıttadhārınīō panavīsam dasa ya sukkadhārınīō
ıya satta sırāsayāım nābhıppabhavāna purısassa 78
tısūnāım ıtthīna, vīsūnāım huntı sandhassa

[Pravacana Sārōddhāra P 402]

7 • Lōkaprakāsa of Śrı Vinayavıjayajı part 1 Sarga-3 Verses 55 to 60

• Pannavanā Suttam P 192 published by Śrı Mahāvıra Jaına Vidyālaya, Bombay

• Brhatsangrahanısūtra of Srī Candrasūrıjı Verse 325

8 • गब्भटिठइ मणुस्सीणुक्किटठा होइ वरिसबारसग

gabbhatthıı manussīnukkıtthā hōı varısabārasagam

[Pravacana Sārōddhāra of Srı Nēmıcandrasūrıjī P 401-A]

• मणुस्सी गब्भे ण भते ! 'मणुस्सी गब्भे'त्ति कालओ केवच्चिर होइ ? गोयमा जहन्नेण अतोमुहुत्त उक्कोसेणं बारस सवच्छराइ ।

manussı gabbhē nam bhantē ! 'manussı gabbhē'ttı kālaō kēvaccıram hōı? gōyamā jahannēnam am'ōmuhuttam ukkōsēnam bārasa samvaccharāım

[Bhagavatı Sūtra part - 1 P 98, published by Śrı Mahāvīra Jaına Vidyālaya, Bombay]

• कोइ पुण पावकारी बारस सवच्छराइं उक्कोस ।
अच्छइ उ गब्भवासे असुइप्पभवे असुइयम्मि ।।

kōi puna pāvakārī bārasa samvaccharāim ukkōsam
acchai u gabbhavāsē asuippabhavē asuiyammi

[Tandulavēyāliya Payannā P 14-A]

9 • कायभवत्थे ण भते कायभवत्थे त्ति कालओ केवच्चिवर होइ ? गोयमा जहन्नेण अतोमुहुत्त उक्कोसेण चउवीस सवच्छराइ ।

kāyabhavatthē nam bhantē kāyabhavatthē tti kālaō kēvaccivaram hōi ? gōyamā jahannēnam amtōmuhuttam ukkōsēnam cauvīsam samvaccharāim

[Bhagavati Sūtra part - 1, P 98, published by Śrī Mahāvira Jaina Vidyālaya Bombay]

• गब्भस्स य कायठिइ नराण चउवीस वरिसाइ ।

gabbhassa ya kāyathii, narāna cauvīsa varisāim

[Pravacana Sārōddhāra of Śri Nēmicandrasūriji P 401 A]

• तु शब्दात मनुष्यतिरश्चा कायस्थिति चतुर्विंशतिवर्षप्रमाणा तावत स्थिति ।

tu śabdāt manusyatiraścām kāyasthitih caturvimśativarsapramānā tāvat sthitih [Tandulavēyāliya Payannā P 6]

10 इमे खलु जीवो अम्मापिउसयोगे माउउय पिउसुक्क ते तदुभय ससटठ कलुस किब्बिस तप्पढमाए आहार आहारित्ता गब्भत्ताए वक्कमइ सत्तह कलल होइ सत्ताह होइ अब्बुयं (सूत्र-१) अब्बुया जायए पेसी पेसीओ य घण भवे।। तो पढमे मासे करिसूण पल जायइ १ बीउ मासे पेसी सजायए घणा २ तइए मासे माउए दोहल जणइ ३ चउत्थे मासे माउयए अगाइ पीणेइ ४ पचमे मासे पच पिडियाओ पाणि पाय सिर चेव निव्वत्तेइ ५ छटठे मासे पित्तसोणिय उवचिणेइ ६ सत्तमे मासे सत्तसिरासयाइ (७००) पच पेसी सयाइ (५००) नव घमनीओ नव नउइ च रोमकूवसयसहस्साइ निव्वत्तेइ (९९ ०० ०००) विणा केसमसूणा । सह केसमसूणा अद्धुटठाओ रोमकूव कोडीओ निव्वत्तेइ । (सूत्र-२) ।

imē khalu jīvō ammāpiusamyōgē māuuyam piusukkam tē tadubhaya samsattham kalusam kibbisam tappadhamāē āhāram āhārittā gabbhattāē vakkamai sattaham kalalam hōi, sattāham hōi abbuyam, (sūtra-1) abbuyā jāyaē pēsi, pēsīō ya ghanam bhavē tō padhamē māsē karisūnam palam jāyai 1 bīu māsē pēsi sañjāyaē ghanā 2, taiē māsē māuē dōhalam janai 3 cautthē māsē māuyaē amgāim pīnēi 4, pañcamē māsē pañca pindiyāō pāni

pāyam siram cēva nivvattēi 5, chatthē māsē pittasōniyam uvacinēi 6, sattamē māsē sattasirāsayāim (700) pañca pēsī sayāim (500), nava dhamaniō nava nauim ca rōmakūvasayasahassāim nivvattēi (99,00,000) vinā kēsamamsūnā saha kēsamamsūnā addhutthāō rōmakūva kōdiō nivvattēi (sūtra-2)

[Tandulavēyāliya Payannā P 7]

11 • दाहिणकुच्छी पुरिसस्स होइ वामा उ इत्थीयाए य । ।

dāhinakucchi purisassa hōi, vāmā u itthīyāē ya

[Tandulavēyāliya Payannā P 6]

• Vicāraratnākara P 171-A

12 • पनपन्नाए परेण जोणि पमिलायए महिलियाण ।
पणसत्तरिइ परओ पाएण पुम भवेऽबीओ ।।

panapannāē parēnam jōni pamilāyaē mahiliyānam
panasattari parāō pāēna pumam bhavē biō

[Tandulavēyāliya Payannā P 4]

• तथा चोक्त स्थानाङगटीकायाम -
मासि मासि रज स्त्रीणामजस्र स्रवति त्र्यह । वत्सरात द्वादशादूर्ध्वं याति पञ्चाशत क्षयम ।।

tathā cōktam sthānāngatīkāyām -
māsi māsi rajah strīnāmajasra sravati tryaham
vatsarāt dvādasādūrddhvam yāti pañcāśatah ksayam

[Ibidem P 5 A]

13 दुन्नि अहोरत्तसए सपुण्णे सत्तसत्तरि चेव । गब्भमि वसइ जीवो अद्धमहोरत्तमणण च ।।

dunni ahōrattasaē sampunnē sattasattari cēva
gabbhammi vasai jivō addhamahōrattamananam ca

[Tandulavēyāliya Payannā P 3 A]

And the Kalpasūtra Subōdhikā commentary on the last Sūtra of the fourth part

14 • मणुस्स पचेदिय तिरिक्ख जोणिय बीए ण भते ! जोणिब्भूए केवतिय काल सचिटठेइ ? गोयमा ! जहन्नेण अतोमुहुत्त उक्कोसेण बारसमुहुत्ता ।

manussa pañcēdiya tirikkha jōniya biē nam bhantē ! jōnibbhūē kēvatiyam kālam sañcitthēi ? gōyamā ! jahannēnam amtōmuhuttam ukkōsēnam

bārasamuhuttā

[Bhagavatī Sūtra part - 1, P 98, published by Śrı Mahāvıra Jaına Vidyālaya, Bombay]

•रिउसमय ण्हाय नारी नरोवभोगेण गब्भसमूह । बारसमुहुत्तमज्झे जायइ उवरि पुणो नेय ।।

rıusamaya nhāya nārı, narōvabhōgēna gabbhasammūha
bārasamuhuttamajjhē jāyaı, uvarım punō nēya

[Pravacana Sārōddhāra P 401]

• बारस चव मुहुत्ता, उवरिं विद्धस गच्छइ सा ।

bārasa cēva muhuttā uvarım viddhamsa gacchaı sā

[Tandulavēyālıya Payannā P 4]

15 तथा चोक्त स्थानाङगटीकायाम -
पूर्ण षोडशवर्षा स्त्री पूर्ण विशन सगता । शुद्धे गर्भाशये १ मार्गे २ रक्ते ३ शुक्रे ४ ऽनिले पुन ।।
वीर्यवन्त सुत सुते ततो न्यूनाब्दयो पुन । रोग्यल्पायुरधन्यो वा गर्भो भवति नैव वा ।।

tathā cōktam sthānāngatıkāyām
pūrna sōdasavarsā strı, pūrna vımsēna sangatā
suddhē garbhāsayē 1 mārgē 2 raktē 3 sukrē 4 'nılē punah
vıryavantam sutam sutē tatō nyūnābdayōh punah
rōgyalpāyuradhanyō vā garbhō bhavatı naıva vā

[Tandulavēyālıya Payannā P 5 A]

N B [The Tandulavēyālıya Payannā The Vıcāraratnākara and The Pravacana Sārōddhāra are published by Srı Dēvacandalālabhāı Jaına Pustakōddhāra Fund Surat]

WE WERE PARTED MANY THOUSANDS OF KALPAS AGO YET WE HAVE NOT BEEN SEPARATED EVEN FOR A MOMENT WE ARE FACING EACH OTHER ALL DAY LONG, YET WE HAVE NEVER MET

D T SUZUKI THE ESSENCE OF BUDDHISM P 26

Appendix I
Index of Proper Names

Appendix II
Glossary
Index of Scientific Terms

Appendix No. III
Glossary
Index of Jain Technical Terms
जैन पारिभाषिक शब्दसूची

अग्नित्याभ (शुक्राभ) *agnityābha (śukrābha)* - One kind of gods/divine bodies out of nine gods

अघातीकर्म *aghātikarma* - The karmas that do not cover the main properties of the soul like etc

अचित्त *acitta* - Nonliving / nonsetient

अठ्ठाई *aththāi* - 1 Group of eight or nine sacred days 2 Penance like fasts of eight days

अणिमा *animā* - A labdhi i e capacity to make one's body micro like anu

अणुव्रत *anuvrata* - Five vows, out of twelve vows for a layperson

अण्डज *andaja* - Animals and birds that reproduce through eggs

अतिशय *atiśaya* - Excellent qualities of Tirthankaras

अधर्म (अधर्मास्तिकाय) *adharma (adharmāstikāya)* - A medium for rest

अधिधर्मा (अहिधर्मा) *adhidharmā (ahidharmā)* - A sub-direction between west and south-west directions

अर्धनाराच *ardhanārāca* - Fourth type of bone-joint interlocking the bones on one side and a pin through both bones

अधोलोक *adhōlōka* - Lower portion of the universe

अध्यवसाय *adhyavasāya* - 1 Thoughts 2 Fillings

अनतकाय *anantakāya* - See **साधारण वनस्पतिकाय Sādhārana Vanaspatikāya**

अनुत्तर देव *anuttara dēva* - Highest quality of gods having highest happiness

अन्तर्मुहूर्त *antarmuhūrtta* - Time less then 1 muhūrtta i e any time from two time units (samayas) to 48 minutes less one time unit

अन्तरजात *antarajāta* - Third type of sound from four types of sound described in Jain scriptures

अन्तरायकर्म *antarāyakarma* - One type of karma that causes unsuccess in any act

अन्धकार *andhakāra* - Darkness or absence of light

अपरत्व *aparatva* - Nearness

regarding to time or place,

अपर्याप्ता *aparyāptā* - A living being which has not sufficient abilities to live

अप्काय *apkāya* - Water-bodied living beings

अप्रशस्त *apraśasta* - Bad or inauspicious

अरिष्ट *arișța* - One kind of gods out of nine Lōkāntika gods

अरुण *aruna* - One kind of gods out of nine Lōkāntika gods

अर्चि, अर्चिमाली *arci, arcimālī* - Types of residences i e vimanas of gods out of nine Lōkāntika gods

अलोक *alōka* - Beyond universe

अलोकाकाश *alōkākāśa* - Space beyond the universe, Transcosmic space

अवगाहना *avagāhanā* - Length or hight of bodies of living beings

अवधिज्ञान *avadhijñāna* - Knowledge through which one can know without the aids of senses the material objects having shape,colour, smell, taste and touch

अवसर्पिणी *avasarpiņī* - Half of time-cycle in which height and life of living being decrease Descending cycle of Six aeons

अव्याबाध *avyābādha* - A place or condition where there is nothing like pain and unhappyness

असंज्ञी *asañjñī* - Living beings that haven't material sensorium/mind, which are not able to think

असंख्यात *asaṅkhyāta* - Which cannot be denoted in numbers or mathematical equation

अशुभ कर्म *aśubha karma* - Inauspicious karma Accumulation of karma through bad deeds

अष्टापद *aşțāpada* - 'A mountain having eight steps', Mt Kailāsa situated in Mt Himālayas

अहिंसा *ahiṃsā* - Nonviolence

आकाश *ākāśa* - Space

आगम *āgama* - Jain canonical books

आतप *ātapa* - Sunlight, Hot radiation

आतपनामकर्म *ātapanāmakarma* - A type of karma which causes hot light

आदित्य *āditya* - One kind of gods out of nine Lōkāntika gods

आध्यात्मिक *ādhyātmika* - Related to the soul

आभामंडल *ābhāmaṇḍala* - Aura or bio-electromagnetic field

आयंबिल *āyambila* - A vow in which person takes food only one time without ghee, oil, milk, curd, jeggery/ sugar and sweets

आयुष्य *āyuṣya* - Life span of living beings

आवलिका *āvalikā* - Unit of time

आहारक वर्गणा *āhāraka vargaṇā* - Specific types of paramānu-units useful for specific body

आहारक शरीर *āhāraka śarīra* - Additonal body of a saint with a specific power

ईशान *īśāna* - 1 A sub-direction between north and east directions 2 A name of second dēvalōka where gods live

ईशित्व *īśitva* - A ability to show the affluence of indra or cakravartī

उत्कृष्ट अनंत अनंत *utkṛṣṭa ananta ananta* - Ninth grade of infinity from the nine types of infinite system

उत्कृष्ट परित्त अनंत *utkṛṣṭa paritta ananta* - Seventh grade of infinity from the nine types of infinite system

उत्कृष्ट युक्त अनंत *utkṛṣṭa yukta ananta* - Fifth grade of infinity from the nine types of infinite system

उत्कृष्ट असंख्यात असंख्यात *utkṛṣṭa asaṅkhyāta asaṅkhyāta* -The highest /ninth innumerable from the nine types of innumerable system

उत्कृष्ट परित्त असंख्यात *utkṛṣṭa paritta asaṅkhyāta* - The seventh innumerable from the nine types of innumerable system

उत्कृष्ट युक्त असंख्यात *utkṛṣṭa yukta asankhyāta* - The fifth innumerable from the nine types of innumerable system

उत्थानी *utthānī* - A sub-direction between the east and south-east directions

उत्पत्तिजात *utpattijāta* - First type of sound from four types of sond that are described in Jain scriptures

उत्सर्पिणी *utsarpinī* - Half of time-cycle in which height and life of living being increase Ascending cycle of Six aeons/epochs

उदय *udaya* - The time in which souls experienced the karma that are attached to them in past Fruition of past karma

उद्देशक *uddēśaka* - A subpart of a chapter of the Jain canonical scriptures

उद्योत *udyōta* - Light like that of

Moon-light

उद्योत नामकर्म ***udyōta nāmakarma*** - A type of karma due to which the moon gives off cold light

उपपात जन्म ***upapāta janma*** - Type of asexual reproduction in hell and divine beings

उपवास ***upavāsa*** - A fast of 36 hours (From previous evening to the next morning)

उपसर्ग ***upasarga*** - Physical or mental annoyance from mankind, beasts-bird and divine beings to Tirthankara and saints

उपशम ***upaśama*** - Subsidence of the karma attached to the soul

उपांशु जाप ***upāṃśu jāpa*** - Repetition of Mantras with a slight noise that is not clear

ऊर्ध्वलोक-देवलोक ***ūrdhvalōka-dēvalōka*** Upper part of the universe

ऋषभनाराच ***rṣabhanārāca***- Second type of bone joint

एकाशन ***ēkāśana*** - A vow of taking food only one time a day

एकेन्द्रिय ***ēkēndriya*** - Living beings having only one sense organ-skin

ऐरवत क्षेत्र ***airavata kṣētra*** A portion of Jambūdvipa

ओघा (रजोहरण) ***ōghā (rajōharaṇa)*** - A sweeping rod with woolen threads of Jain monks and nuns

ओजाहार ***ōjāhāra*** - Intake by an embryo in the form of blood and semen, sapdrawn from parents

औदारिक वर्गणा ***audārika vargaṇā*** - Specific types of paramānu-units useful for the body of the living beings other than divine and hell beings

औदारिक शरीर ***audārika śarira*** A gross body of living beings other than divine and hell beings

कटाह ***katāha*** -Hanging half ribs

कपाल ***kapāla*** Skull

कपिला ***kapilā*** - A sub-direction betwen south and south-east

कल्याणक ***kalyānaka*** Five specific incidents in the life of Jain Tirthankara ,1 Ascending of the soul in the womb of mother, 2 Birth, 3 Initiation, 4 Attaining omniscience and 5 Emancipation

कवलाहार ***kavalāhāra*** A food taking with mouth, The in take of gross food

कायस्थिति ***kāyasthiti*** Time spent in the same species

कायोत्सर्ग ***kāyōtsarga*** - Meditation technique prevalent in Jain tradition

कार्मण वर्गणा ***kārmaṇa vargaṇā*** - Specific types of paramānu-units useful for bondage of karma

कार्मण शरीर ***kārmaṇa śarīra*** - Karmik body, cause of all bodies

काल ***kāla*** - Time

कालचक्र ***kālacakra*** - Time-cycle, contains 12 epochs, 6 in utsarpinī (ascending part) and 6 in avasarpinī (desending part)

कालोदधि ***kālōdadhi*** - A circular ocean around the

कीलिका ***kīlikā*** - Fifth type of bone joint, pin betwen two bones

कुर्मोन्नता ***kurmōnnatā*** - Type of yoni i e female reproductive organ

कृष्णराजि ***kṛṣṇarāji*** A black portion under the fifth heaven named Brahma that contains darkness

केवलज्ञान ***kēvalajñāna*** - Omniscience

केवली ***kēvalī*** - A person that possesses omniscience

क्रोश-गाउ-कोश ***krōśa-gāu-kōśa*** - An unit of length that is equal to 2000 dhanuṣyas

क्षय ***kṣaya*** - Eradication of karma attached to the soul

क्षयोपशम ***kṣayōpaśama*** - Eradication-cum-Mitigation of karma

खरतरगच्छ ***kharataragaccha*** - A sub-sect of Jain monks

खेलिद्या ***khēlidyā*** - A subdirection between south and south-west

गरिमा ***garimā*** -A labdhi i e capacity of a man to make his body too much heavy

गणधर ***ganadhara*** - Prime disciple of Tīrthankara

गंगा ***gangā*** - A river coming from east side of lake Padma situated on Mt Himavat

गर्दतोय ***gardatōya*** - One kind of gods out of nine Lōkāntika gods

गर्भज जन्म ***garbhaja janma*** - Sexual reproduction with copulation of male and female

गोत्र कर्म ***gōtra karma*** - A kind of karma due to which one takes birth in lower cast or higher cast

ग्रहणजात ***grahaṇajāta*** - Fourth type of sound from four types of sound described in Jain scriptures

घाती कर्म ***ghātī karma*** - The karmas covering the main properties of the soul like

infinite-knowledge, etc

चउरिंदिय (चतुरिन्द्रिय) *caurindiya (caturindriya)* - Living beings having four sense organs - skin, tounge, nose and eyes

चउविहार *cauvihāra* - A vow of not taking food,water etc after sunset to sunrise

चंद्राभ *candrābha* - A place of one kind of gods out of nine Lōkāntika gods

चातुर्मास *cāturmāsa* - Four months of rainy season

छद्मस्थ *chadmastha* - A living being who has not attained omniscience, who is 'covered'

जघन्य अनंत अनंत *jaghanya ananta ananta* - Third type of infinite from the nine types of infinite system

जघन्य परित्त अनंत *jaghanya paritta ananta* - First type of infinite from the nine types of infinite system

जघन्य युक्त अनंत *jaghanya yukta ananta* - Second type of infinite from the nine types of infinite system

जघन्य असंख्यात असंख्यात *jaghanya asankhyāta asaṅkhyāta* - Third type of innumerable from the nine types of innumerable system

जघन्य परित्त असंख्यात *jaghanya paritta asaṅkhyāta* - First type of innumerable from the nine types of innumerable system

जघन्य युक्त असंख्यात *jaghanya yukta asankhyāta* - Second type of innumerable from the nine types of innumerable system

जम्बूद्वीप *jambūdvīpa* - A continent in the central portion of Madhyalōka (Tircchālōka) having diameter 1,00,000 yōjanas

जरायुज *jarāyuja* - Type of sexual reproduction with wrapper containing blood born with placenta

जाप *jāpa* Repetition of mantras

जीव *jīva* A living being

ज्योतिष्क देव *jyōtiṣka dēva* - A divine body like sun, moon, planets and stars etc Sun god, Moon god etc

ज्ञानावरणीय कर्म *jñānāvaranīya karma* - A karma that covers the property of knowledge

तपागच्छ *tapāgaccha* - A sub-sect of Jain monks

तमस्काय *tamaskāya* - Black substance in Krsnarāji under the fifth heaven named Brahma

तिर्यंच *tiryañca* - Living beings

other than man, divine and hell beings

तिविहार ***tivihāra*** - A vow of taking only water during the whole night

तीर्थंकर ***tīrthankara*** - The 'conqueror' of rāga and dvēsa

तीर्थंकर नामकर्म ***tīrthaṅkara nāmakarma*** - A type of karma necessary for a Tīrthankara

तेइन्द्रिय ***tēindriya*** - Living beings having three sense organs skin, tounge and nose

तेउकाय - तैजस्कायिक ***tēukāya - taijaskāyika*** - Fire bodied living beings

तैजस् वर्गणा ***taijas varganā*** - Specific types of paramānu units useful for vital body or bio-electromagnetic field

तैजस् शरीर ***taijas śarīra*** The vital body a cause of bio-electromagnetic energy/field

त्रसकाय ***trasakāya*** - Animal kingdom (moving animals)

त्रिपदी ***tripadī*** - A trio of sentences told by Tīrthankara to the prime disciples

दर्शनावरणीय कर्म ***darśanāvaraṇīya karma*** - A karma that covers the property of right faith

दुषम ***duhṣama*** - The fifth epoch of avasarpinī and second epoch of utsarpinī, a period of privation

दुषम-दुषम ***duhṣama-duhṣama*** - The last epoch of avasarpinī and the first epoch of utsarpinī, a period of extreme privation

दुषम सुषम ***duhṣama-susama*** The fourth epoch of avasarpinī and the third epoch of utsarpinī, a period of privation and plenty

दीक्षा ***dīkṣā*** - Initiation

देव ***dēva*** - Divine beings, gods

देवपरिघ ***dēvaparigha*** - Name of seventh Krsnarāji out of eight Krsnarājis

देवपरिघोक्षोभ ***dēvaparighōkṣōbha*** - Name of eighth Krsnarāji out of eight Krsnarājis

देवी ***dēvī*** - Divne beings godesses

देशना ***dēśanā*** - Sermon of Tīrthankara

द्वादशाङ्गी ***dvādaśāngī*** Twelve sacred Jain canonical treatises

द्वीन्द्रिय ***dvīndriya*** - Living beings having two sense organs skin and tounge

धर्म(धर्मास्तिकाय) ***dharma(dharmāstikāya)***

- A medium for motion

धर्म ***dharma*** - 1 Spirituality 2 Philosophical tradition

धनुष्य ***dhanuṣya*** -Unit of length equal to 4 hātha or 6 feet

धातकीखंड ***dhātakīkhaṇḍa*** -A circular continent around the ocean Lavanasamudra

ध्यान ***dhyāna*** - Meditation

नमस्कार महामंत्र (नवकार) ***namaskāra mahāmantra (navakāra)*** - A main mantra of Jainism

नय ***naya*** - A philosophical view point, A partial view

नवकारशी ***navakārasī*** - A vow of taking food and water after 48 minutes of sunrise

नामकर्म ***nāmakarma*** -A type of karma due to which soul obtains body etc

नारक ***nāraka*** - 1 Hell 2 Hell beings

नाराच ***nārāca*** - Third type of bone joint, interlocking of bones on both sides

निगोद ***nigōda*** - Sūksma Sādhārana Vanaspatikāya that contains infinite souls

निर्विकृतिक ***nirvikṛtika*** - Non-infatuating food, The food items that do not defile the soul, made from six vigai(vikrti)s that defile the soul like Ghee, Milk, Curd, Jaggery, Oil and sweets

निश्चयकाल ***niścayakāla*** - A real time, – A type of time – that becomes cause of the change in the condition of material objects according to omniscience

निश्चयनय ***niścayanaya*** - Absolute view-point

निषध ***niṣadha*** - A name of mountain in Jambūdvīpa

नीवि ***nīvi*** - A vow of taking nirvikrtika food only once a day, that do not defile the mind

परकायशस्त्र ***parakāyaśastra*** -Any opposite substance that renders living organism dead

परमाणु ***paramānu*** The smallest indivisible particle of matter

परत्व ***paratva*** - Farness regading to time or space (place)

परिग्रह ***parigraha*** - 1 Hoarding of worldy things 2 Attachment to worldy things, possession

परिणाम ***parināma*** - 1 Feelings 2 change, transformation

परियाधर्मा ***pariyādharmā*** - A sub direction between west and north-west directions

परिषह ***pariṣaha*** Inconvenient conditions like hunger, thirst,

cold, heat etc that are 22 in number

पर्यवजात ***paryavajāta*** - Second type of sound from four types of sound

पर्याप्ता ***paryāptā*** - A living being which has sufficient abilities to live

पर्याय ***paryāya*** - A micro or macro transformation in a substance

पर्युषणा ***paryuṣanā*** - A group of eight days from śrāvana vada-12 to bhādaravā suda 4

पर्वतिथि ***parvatithi*** - Main days like 2nd, 5th, 8th, 11th, 14th and 15th in each half of Indian month

पल ***pala*** - Ancient unit of weight

पल्योपम ***palyōpama*** - 1 The unit of time which contains uncountable years, 2 'Pit measured' period

पश्चानुपूर्वी ***paścānupūrvi*** - Reverse order

पञ्चेन्द्रिय ***pañcēndriya*** - Living being having five sense organs skin, tounge, nose, eyes and ears

पुद्गल ***pudgala*** - Matter

पुष्करवर द्वीप ***puṣkaravara dvīpa*** - A circular continent around the ocean Kālōdadhi

पूर्व ***pūrva*** - Unit of time equal to 70,56,000,00,00,000 years

पूर्व ***pūrva*** - The 14 sacred canonical treatises of Jainism also known as 12th anga, Drstivāda

पूर्वानुपूर्वी ***pūrvānupūrvi*** - Regular sequence

पृथकत्व ***prthakatva*** - Any number from two to nine numbers

पृथिवीकाय-पृथ्वीकाय ***pṛthuvikāya-pṛthvikāya*** - Earth-bodied living beings

पोतज ***pōtaja*** - Type of sexual reproduction, without wrapper vertebrates without placenta

प्रक्षेपाहार ***prakṣēpāhāra*** - A food taking through the hole or with injection

प्रज्ञवृत्ति(प्राज्ञवृत्ति) ***prajñavrtti(prājñavrtti)*** - A sub direction between north and north-east directions

प्रज्ञापक ***prajñāpaka*** - A person who is telling

प्रतिक्रमण ***pratikramaṇa*** - Retreat from sin

प्रत्याख्यान ***pratyākhyāna*** - A vow of abstaining from certain things for a certain period

प्रत्येक वनस्पतिकाय ***pratyēka vanaspatikāya*** - Having

single soul in a single body of plant like seed, leaf, root, flower etc

प्रदेश ***pradēśa*** - 1 A single paramānu 2 A point of space for only single paramānu, Space unit

प्रभंकर ***prabhaṅkara*** A place of one kind of gods/divine bodies out of nine Lōkāntika gods

प्रभा ***prabhā*** - Irregular spread, reflection etc of light

प्रमोद भावना ***pramōda bhāvanā*** - To rejoice in

प्रव्रज्या ***pravrajyā*** - Initiation

प्रशस्त ***praśasta*** Good, Of good quality

प्राकाम्य ***prākāmya*** A 'labdhi' (potentiality) through which one can walk on water or enter in earth as if it was a water

प्राप्ति ***prāpti*** - A 'labdhi' (potentiality) through which one can touch the top of Mt Mēru from the surface of the earth

प्रासुक ***prāsuka*** - Nonliving i e soul-less food etc

बादर(बायर) ***bādara(bāyara)*** - Gross

बियासण ***biyāsana*** - A vow of taking food twice a day

बेइन्द्रिय ***bēindriya*** Living being having two sense organs skin and tounge

ब्रह्म देवलोक ***brahma dēvalōka*** - A name of the fifth heaven

भरत क्षेत्र ***bharata ksētra*** A section of Jambūdvīpa

भव ***bhava*** 1 Birth, 2 The world

भवनपति ***bhavanapati*** A type of divine bodies i e gods and godesses

भवस्थिति ***bhavasthiti*** Time spent in the same body, i e life-span

भामंडल ***bhāmandala*** - A divine circular light behind the head of Tīrthankara aura

भाव ***bhāva*** -1 Feelings 2 Thoughts

भावना ***bhāvanā***- To ponder, To think again and again over same truth

भाषावर्गणा ***bhāṣāvarganā*** - Specific type of paramānu units useful for speech or sounds

भाष्यजाप ***bhāṣyajāpa*** - Repetition of mantras with a loud pronounciation

भुजपरिसर्प ***bhujahparisarpa*** - Reptiles

भोगोपभोग विरमण व्रत ***bhōgōpabhōga viramana vrata*** - A 7th vow of laypersons in which person puts limit on use of worldy things

मुंहपत्ति **mumhapatti** - A mouth cloth

मुहूर्त **muhūrtta** - 48 minutes

मेघराजि **mēgharāji** - 1 A name of Nārakī 2 Second Krṣnarāji out of eight Krsnarājis

मेरु **mēru** - Central mountain in Jambūdvīpa

मोक्ष **mōkṣa** - Emancipation

मोहनीय कर्म **mōhanīya karma** - Infatuating karma

मौन(मानस) जाप **mauna(mānasa) jāpa** - Repetition of mantras without even a little noise

यतना(जयणा) **yatanā(jayanā)** - Doing every thing with care that any living being should not hurt through the action

योगी **yōgī** - A saint

योनि **yōni** - 1 Types of birth places 2. Female reproductive organ

रक्तवती **raktavatī** - A name of river of Airavata in Jambūdvīpa

रक्ता **raktā** - A name of river of Airavata in Jambūdvīpa

रज्जु(राजलोक) **rajju(rājalōka)** - 14th part of height of universe according to Jainism

रत्नप्रभा **ratnaprabhā** - The name of the first hell

रम्यक् **ramyak** - A section of Jambūdvīpa

रिष्ट **riṣṭa** - One kind of gods/divine bodies out of nine Lōkāntika gods

रुक्मि **rukmi** - A name of mountain in Jambūdvīpa

रुचक प्रदेश **rucaka pradēśa** - 1 Eight space points located in the centre of the universe 2 Eight most micro-units of soul that are totally free from karma

लघिमा **laghimā** - A 'labdhi' potentiality to make body too much lighter

लघुहिमवान् **laghuhimavān** A name of mountain in Jambūdvīpa

लब्धि **labdhi** - An extrasensory power, Miraculous power

लवण समुद्र **lavana samudra** - The ocean around the Jambūdvīpa

लोक **lōka** - The Universe

लोकाकाश **lōkākāsa** - Universal space, Cosmic space

लोमाहार **lōmāhāra** - Food taken through hairs and skin

वज्रऋषभनाराच **vajrarṣabhanārāca** -First type of bone joint, interlocking the bones on both sides,streghtened with plate and pin

वनस्पतिकाय **vanaspatikāya** - Plant kingdom

- Specific type of paramānu-units for the desire-body and the body of divine & hell beings

वैक्रिय शरीर ***vaikriya śarīra*** - A desire-body

वैरोचन ***vairōcana***- A place of one kind of gods out of nine Lōkāntika gods

वैताढ्य ***vaitāḍhya*** - A mountain dividing the Bharata ksētra into two sections

वैमानिक ***vaimānika*** - A type of gods & goddesses

व्यन्तर ***vyantara*** - A type of gods & goddesses

व्यवहार काल ***vyavahāra kāla*** - A type of time used in our daily life

व्यवहार नय ***vyavahāra naya*** - Relative or practical view point

शतक ***śataka*** - A part of a chapter of Bhagavatīsūtra

शंखावर्त ***śamakhāvarta*** -Type of yōni, A female reproductive organ

शाश्वत(ती)***śāśvata(tī)*** - 1 Eternal 2 immortal

शिखरी ***śikharī*** - The name of mountain in Jambūdvīpa

शीर्षप्रहेलिका ***śīrṣaprahēlikā*** - Heighest numerical value mantioned in Jain scripture having 250 or 194 digits

शुक्राभ ***śukrābha*** - A place of one kind of gods out of nine Lōkāntika gods

शुभकर्म ***śubhakarma*** - Auspicious karma

श्यामा ***śyāmā*** - A sub-direction between north-east and east

श्रावक-श्राविका ***śrāvaka-śrāvikā*** - A layman & laywoman of Jainism

श्रुतस्कन्ध ***śrutaskandha*** - A volume of Jain canonical treatises

श्वासोच्छ्वास वर्गणा ***śvāsōcchvāsa varganā*** - Specific type of paramānu-units useful for respiraton of all living beings

सचित्त ***sacitta*** Living i e having life

सनत्कुमार ***sanatkumāra*** - A name of third heaven

समय ***samaya*** - The most micro-unit of time

समयक्षेत्र ***samayakṣētra*** - A circular field having the dimeter 45,00,000 yojanas where there is time like day & night

समवसरण ***samavasarana*** - A special assembly for sermon of Tīrthankara

सम्मूर्च्छिम जन्म ***sammūrcchima janma*** Asexual reproduction

सम्यक्त्व ***samyaktva*** - A faith on

touche only

स्कन्ध ***skandha*** - Aggregate of paramānus, clusters of matter.

स्तुति(स्तोत्र) ***stuti(stōtra)*** - A hymn

स्त्रीरत्न ***strīratna*** - Chief queen of Cakravartī

स्याद्वाद ***syādvāda*** - The theory of seven folded logical prediction assimilating dissimilar viewpoints

स्वकायशस्त्र ***svakāyaśastra*** -A similar substance that renders living beings dead

स्वदारासंतोष विरमण व्रत ***svadārāsantōṣa viramaṇa vrata*** - A vow of abstention from sexual activity with a woman other than one's own wife

स्वाध्याय ***svādhyāya*** -To study

हरिवर्ष ***harivarṣa*** A part of Jambūdvīpa

हाथ ***hātha*** - Unit of length eqal to 1 5 foot

हिमवन्त ***himavanta*** - A part of Jambūdvīpa

हिमवान् ***himavān*** - A mountain in Jambūdvīpa

हैरण्यवत् ***hairanyavat*** A part of Jambūdvīpa

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Muni in pursuit of science through Jain treatise

RANDOM NOTES

By Tushar Bhatt
(Senior Editor, The Times of India, Ahmedabad Edition)

In the spacious first floor hall at the Ambawadi Jain Upashraya silence ruled, A few monks here and there, disciples of Acharya Suryodayasuriji were seated on the floor, in front of small, reclining writing desks There were only a couple of devotees around whispering in order not to jar the peace Outside, there was a steady drizzle and the afternoon was dragging on at a drowsy pace as if reluctant to make way for the evening The monks seemed totally obvious to the somnolence that the weather was casting on worldly mortals

Dressed in the mandatory white cloth of a Jain monk Muni Nandighoshvijayji was absorbed in writing Several ruled foolscap pages filled with neat handwriting lay around Next to him stood a rack filled with books for reference

He was making notes on a subject that many might think unlikely topics to preoccupy celestial mind of monks mathematics and purer physics, Einstein's theories quantum leap This in addition to the routine chores of a monk

If Tao of Physics can be acceptable, it is, perhaps perfectly in order for a monk to undertake a reverse examination of science Learning has been a time-honoured tradition among the Jain monks as would be testified by the works done over centuries Even today new entrants to the order under any Acharya spend years Sanskrit Prakrit and Agams and other literature Acharya Suryodayasuriji himself has done a lot of work in researching and writing in these areas

But 42 year Nandighoshvijayji has charted almost a new course for nearly a decade and a half now, exploring pure science and examining its compatibility with what has been observed and remained buried to the common eye, in the Jain scriptures

The Muni with a frail body, topped by a head with receding hairline face covered deliberately uncared for beard that sprouts many grey strands, has a winsome smile sparkling eyes and a scientific temper, He triggered a debate on

serious and profound topics in mathematics and physics by delving in to Jain Agamshastras and examining the modern theories vis-a-vis them and brought out a book, *Jainism Through Science* both in English and Gujarati containing articles on what he has studied, observed and compared between ancient writings and the modern thought in these complex areas

Nandighoshvijay who received vows 23 years ago was known as Nirmalkumar Nagindas Shah in his previous identity and was keen student of science and mathematics After eight years of his monkhood mastering Sanskrit and Prakrit to be able to study the scriptures, he took to empirical examination of the scientific concepts has expounded in the Jain scriptures and the modern day scientific thoughts

The scriptures he said were 2500 years old and were preserved in oral traditions for a thousand years before being put on palm leaves

He does not find anything odd in what he is doing He is not a dogmatic person out to prove something with a fanatic finality, he has triggered a rational debate

His articles in the book discuss a host of intricate issues such as concept of time and its units origin and development of the universe Darwin's theory of evolution units of time and their relativity, the atomic theory of construction of material objects and energy the corpuscular theory and the wave theory of light

The basic scientific introduction to each topic has been followed up with a detailed discussion according to the Jain philosophical tradition Dr P C Vaidya a mathematics don of renown has noted that after awakening interest in both traditions the Muni attempt to compare them

Dr Vaidya went on the observe The results of the comparison of these different traditions will hardly be acceptable to all Muni Nandighoshvijayji, who makes the comparison is proficient in the reflective philosophical tradition If the reader, like me is a lover of empirical tradition, may not fully accept the conclusions, but that does not at all diminish the important of these writings

What Muni Nandighoshvijayji has done is to set out various themes that indicate that Jain concept of science accord well with the modern science The Jain concept of science is qualitative as expounded by tirthankaras while modern science is very much quantitative as has been noted by Prof Kanti V Mardia, who holds the chair in Applied Statistics and is director of Centre of Medical Imaging Research at the University of Leeds in England

Normally philosophy and religion on one hand, and science, on the others, belong to different fields since philosophy is based on thinking and reflection and science on experience But Albert Einstein himself noted in 1940 that both sides were not totally incompatible

Einstein wrote in an article, *Science & Religion,* in Nature magazine 57 years ago that Science without religion is lame, religion without science is blind Science is the attempt at the posterior reconstruction of existence by the process of conceptualisation

The task is ambitious For instance an article in the book on some shortcomings of the theory of special relativity according to Jainology, the Muni has made an attempt to point up drawbacks in Einstein s Special Theory of Relativity (STR) by putting forth arguments derived from the interpretation of Jain philosophy, with support from the hypothesis on the existence of "tachyon' which are currently postulated to have a velocity higher than light

Einstein's theory being challenged by many scientists too, but, as Mr P Tewari an officer of the Atomic Energy Commission's Nuclear Power Board has noted the reasons for the refutation by others were more profound and subtler than what was put forth in the Muni s paper

Nandighoshvijayji himself says that Since I am Jain Muni there are many limitations regarding practical work I have not tested the (scientific) principles in Jain Philosophical treatises practically I arrived at the conclusions on the basis of natural phenomena and social experience The research paper are only theoretical '

Nevertheless he thinks that since many scientific principles lay hidden in ancient Jain treatises, it is very necessary to represent these in the modern world

Acknowledging that this was too tall an order for a single individual he fells that science has not discovered the complete truth yet Eventually, in pure sciences such as mathematics conceptualisation played an important role

The immediately perceptible merits or otherwise apart Muni Nandighoshvijay appears to be set on a life time course of comparative studies of scripture and science What he inscribed on a copy of his book summed up his motto Knowing is not enough, we must apply Willing is not enough we must do '

(The Times of India, Ahmedabad, Saturday, August, 2, 1999)

If the reader like me, is a lover of the empirical tradition, he may not fully accept the conclusion of the comparison made by the author But that does not at all diminish the importance of these articles

Dr P C Vaidya (A great mathematician of India)

The presentation of the papers by Jain Muni Nandighoshvijay is lucid and quite impressive Some of the concepts mentioned in the papers need a very serious explanation in order to dwell deeper into the mysterious working of nature

Prof H. F Shah, (Head, Deptt. of Physics, St. Xavier's College, Ahmedabad)

I went through the manuscript and found the theories very interesting I would like to convey my best wishes in your endeavour

Dr Satya Prakash (Emeritus Prof., PRL, Ahmedabad)

In the age of wide-spread scientific progress religion should be taught through the language of science and by relating it to interesting topics selected from various branches of science Muni Shri Nandighoshvijayji is wonderfully doing just the job

Dr Pradip K. Shah M. D., (487, Jeremy, Bour Bonnias, ILL 60914, USA)

I think that you have brought out the concept of the Einstein's theory extremely well I agree with the conclusion arrived at by you in your initial review

I am very much glad and delighted to learn that though you are a worshipable Jain Swami, you have got great interest in the scientific advanced subjects like special theory of relativity, quantum mechanics and black holes etc and even you are engaged in research in these highly scientific subjects It is a great pride for India and for Jainism I congratulate you for being a part of this big mission

Dr Shamtilal M Shah, (Retd Scientist, Bhabha Atomic Research Centre, Trombay, Bombay)

In my opinion It is a noble task to 'relate' the concept of modern science to Jain thoughts and vice-versa I congratulate you for this important and timely contribution and in particular I whole heartedly recommend the book to the scientific community Jains and non-Jains alike

Prof K V Mardia, Ph.D (Raj) Ph.D, (N'cle), University of Leeds, LEEDS, U.K.